RAILROAD GAZETTE

FRIDAY, AUGUST 31, 1900.

CONTENTS

ILLUSTRATED:
Track Inspection Apparatus of U. of I. and Peo. & E. 576, 577
Oak Point Yard—N. Y., N. H. & H. 579
New Steel and Iron Foundry—Sargent 580, 581
Diagonal Bracing Over Turntable in Swing Bridges .. 581

CONTRIBUTIONS:
Trusts and the Engineer 575
The Wide Fire-Box and the Atlantic Type 575
The Purification of Feed-Water 575

EDITORIAL:
The Railroads of India 582
A Measure of Engine Performance 582
Annual Reports 583
English Employees' Safety Law 583
Editorial Notes 582, 583
New Publications 583, 584

MISCELLANEOUS:
The Transportation Show at Paris 575
Ton-Mileage for Motive Power Statistics 575, 576
Fitting Steam Railroads for Electricity 577, 578
Keeping Up Line and Grade 578, 579
Railroad Police and the Tramp 579
The Rogers Locomotive Works 581
A Measure of Engine Performance 584
Six Months of Railroad Building in 1900 ..... 584, 585
Painting Penna. R. R. Locomotives 585, 586

GENERAL NEWS:
Technical 586
The Scrap Heap 586
Locomotive Building 587
Car Building 587
Bridge Building 587
Meetings and Announcements 587
Personal 587
Elections and Appointments 588
Railroad Construction 588
General Railroad News 588

Contributions

Trusts and the Engineer.

Newton, Iowa, Aug. 21, 1900.

TO THE EDITOR OF THE RAILROAD GAZETTE.

Why will not Mr. Charles H. Wright treat the engineer as the physician is treated? See the article quoted in the *Railroad Gazette* of Aug. 17, entitled "Trusts and the Engineer." D. H. AINSWORTH.

The Wide Fire-box and the Atlantic Type.

Pittsburgh, Pa., Aug. 17, 1900.

TO THE EDITOR OF THE RAILROAD GAZETTE.

I am in receipt of the *Railroad Gazette* (Aug. 3) containing the description of the new Chicago & Northwestern passenger engines. To me these engines appear to be a step in the right direction, and they will do much to promote the introduction of the wide fire-box for bituminous coal. I think, however, that the waste of adhesion weight which is inherent in the Atlantic design will finally condemn it, and I entirely concur in the views of Mr. S. M. Prince, Jr., published in the *Railroad Gazette* of June 22 to the effect that a wide fire-box and large driving wheels can be efficiently combined in an engine of the American or ten-wheel type.

I will, however, indorse any wide fire-box Atlantic type engine that may be produced simply in the interest of the wide fire-box; leaving its further adaptation to be determined later on. Any one who observes a narrow fire-box engine, spending a large part of its power in pushing the steam out of the cylinders in order to overwork an insufficient grate area, ought to be persuaded of the substantial advantage of the wide fire-box.

J. SNOWDEN BELL.

The Purification of Feed-Water.

15 Wall Street, New York, Aug. 28, 1900.

TO THE EDITOR OF THE RAILROAD GAZETTE.

Knowing that your only aim is to seek the truth and to present it to your readers, I wish to call attention to your editorial on page 568 of the issue of Aug. 24, wherein you discuss the results obtained by the use of various forms of water softening apparatus in Europe and one in this country, and then say "The weakness of the whole process of chemical purification is in the imperfect character of the result."

This statement if expressly limited to chemical treatment as exemplified by some of the European machines referred to would be nearly correct, but in the broad way in which the statement stands it is not correct.

There is nothing much more exact or complete known to scientific men than a chemical operation carried out on a small scale. The want of exactness in chemical operations on a large scale is due entirely to the physical difficulty of treating large bodies of liquid uniformly; or, in other words, to the mechanical deficiencies of the apparatus used.

Inspection of the results of treatment by different machines given on page 569 of the same issue shows marked inequalities. Some of the machines referred to would be classed by any competent water softening engineer as "freaks," since no water softening machine in these days is worthy of the name if it fails to reduce any kind of water to a hardness not exceeding 4 degrees, or to water containing rather less than a total of 4 grains per gallon of dissolved salts of calcium and magnesium.

The "imperfect character of the result" sometimes found is not due to the "process of chemical purification" but to the imperfect character of some of the apparatus used for the purpose.

C. HERSCHEL KOYL.

The Transportation Show at Paris.

The Northern Railroad of France shows at Vincennes locomotive No. 2,642, being a four-cylinder compound. Since 1886 this company has systematically tried compound engines, the original one put in service that year being still at work. Seven years ago the company began the introduction of road engines, compound, of various classes, which have been gradually modified and improved. The example shown now is a lineal descendant of No. 2,122, which was shown at Chicago in 1893, and No. 2,160, which was shown in 1897 at Brussels. The company now has in service 60 compound engines. The latest engines in passenger service take a train of 200 tons up a grade of one-half of one per cent. near Saint Denis, about 12 miles, at 56 miles an hour, and haul the same train down that grade at from 68 to 74 miles an hour. The engines of the class exhibited, namely, Nos. 2,641 and 2,642, have been designed by Mr. Bousquet to go up this grade of one-half of one per cent. at 62 miles an hour. Naturally, the increase in power has necessitated a larger grate surface and bigger boiler, and as a consequence these latter engines have a carrying axle behind the drivers. The engine shown weighs 64 metric tons, 33 tons being on the drivers.

Ton-Mileage for Motive Power Statistics.

BY C. H. QUEREAU.

There are so many points in connection with this subject on which opinions differ radically that it seems wise to confine the present study chiefly to the following: "Should the tonnage of the engine be included in the ton-mileage?"

Cost.—I am strongly inclined to believe that an important reason for advocating an operating department basis for judging the efficiency of the motive power department, both by the management and motive power officers, is the belief that two sets of ton-mileage figures, one for determining the efficiency of the operating department and the other adapted to the needs of the motive power department, would double the cost. A knowledge of the facts will dispel this belief.

In all probability the ton-mileage compiled for the operating department will show that for the train back of the engine. This being true, the expense for adding the ton-mileage of the whole train will be so small that it cannot be figured with certainty. This is true because the ton-mileage of any engine for each district is always the same, and the additional expense will be covered by that necessary to set the figures down and add them to the previously determined ton-mileage back of the tender. For instance, if a 100-ton engine handles a train over a 120-mile district, the constant ton-mileage for every engine of the same class over this district will always be 12,000 ton-miles, whatever the tonnage of the balance of the train. On one road the constants for the engines are added in the Car Accountant's office, taken from a table showing them for all classes on all districts. The ton-mileage handled in this office for the year ending June 30, 1900, was 4,689,533,115. The Car Accountant writes: "We find it somewhat difficult to say just how much extra it costs us to compute ton-mileage of way cars and engines, but believe $6 per month will about cover it."

On another line these constants for the engines are added in the office of the Superintendent of Motive Power to the figures giving the ton-mileage for the balance of the train furnished by the Car Accountant. The Superintendent of Motive Power writes: "This is about one day's work a month for our statement clerk." Concerning the same matter another Superintendent of Motive Power says: "I am not in a position to give you the cost, but it must be nominal inasmuch as no special labor is involved."

In view of these facts it seems fair to conclude that the cost of ton-mileage figures for the motive power department, including that of the engines, should add not more than $75 or $100 per year to the cost of obtaining them for the operating department; which should not be prohibitive.

The Operating Department View.—As far as I can learn from the reported discussion, there appear to have been but two special reasons offered for not including the weight of the engine in the ton-mileage. First: the motive power official should study the efficiency of his department from the standpoint of an operating officer, because he, with the management, is interested in "knowing what an engine does behind the tender." Second, the locomotive should not receive credit for the work expended in hauling itself, because if so credited superiority of design will not be shown.

I cannot agree with the proposition that the motive power officers should judge of the efficiency of their work from the operating department point of view. It occurs to me that the problem of designing the most economical engines and keeping them at their maximum efficiency for the least money is quite different from that of securing the greatest work from them while in service on the road. As I understand it, the statistics of the motive power department are intended as a basis by which to determine whether the best types of engines are in use and if the money appropriated for their maintenance and supplies is judiciously spent, while the operating statistics are used for determining whether the engines "are hauling what they are supposed to haul." The ton-mile basis for both departments harmonizes these interests, which is one of the controlling reasons for its adoption in place of the engine-mile basis, which makes them antagonistic, but it does not necessarily follow that the ton-mileage for both should be the same.

I believe it is a fair proposition that the ton-mileage for motive power statistics should show all the work done by the money expended, as the money spent per unit of work is the basis by which this department is judged. On the other hand the operating department is judged by the amount of work done per train or per car, and usually not on the basis of cost per unit of work done. These facts seem to me to warrant the conclusion that the ton-mileage used by each department should be different.

I believe that an analysis of the conditions under which the motive power department works, closer than was made either in the committee's report or the discussion of it, will prove interesting.

On prairie roads the use of double-headers and pusher or helper engines is comparatively small, and the weight of the engine on a freight train is but 10 per cent., or less, of the total weight. Under such circumstances it may make little difference whether the weight of the engine is included in the ton-mileage or not, though I am of the opinion that it is a just credit, and should be included if motive power expenses are to be accurately judged. There are a number of lines and divisions where the grades are heavy, the use of pusher engines and three engines to each freight train, and two engines for all passenger trains having more than five cars, is necessary to economical operation and is the normal practice, and under these conditions the weight of the motive power is 30 per cent. of the total weight of the freight trains when the engines are loaded to their full capacity and the speed is eight miles an hour up the grades. It will be evident that when the speed of the trains is higher the weight of the load must necessarily be lighter and the weight of the engine a larger per cent. of the total.

I am personally acquainted with a number of districts, of considerable length, where the light engine-mileage is fully 30 per cent. of the total, because of the large number of engines in pusher and helper service; and it is on these districts where the weight of the motive power averages more than 30 per cent. of the total weight of the trains. It follows that under these conditions at least 30 per cent. of the work done by the engines is absorbed in moving themselves. It seems to me hardly a fair proposition that under these conditions it is just to compare the efficiency of the motive power management with that of the districts where pusher and helper engines are comparatively rare, and one engine to a train the rule, on the basis of the work done behind the tender, even though the management wants this information for the purpose of determining the cost of operating such districts. That there is a considerable number of roads operating under these disadvantages will require but a few moments consideration to prove.

Should the recommended practice that only the ton-mileage of the train behind the tender be approved, I am thoroughly persuaded that there is a considerable number of roads operating mountain divisions that cannot see the justice of the recommendation and will decline to follow it. If this is a just conclusion, will it not be wiser to propose as recommended practice to include the weight of the entire train for motive power statistics, and by so doing have an equitable rule for lines with light and those with heavy grades? I am encouraged to make this suggestion because one of the staunchest advocates of the "behind the tender" plan, whose opinions I greatly respect, and who is responsible for the motive power expenditures on a road noted for its light grades, when speaking of the influence of including the tonnage of the engine on a comparison of the fuel records, said: "I think, in analyzing the figures and seeing how much it amounts to, to put the weight of the engine in these ton-mile figures does not amount to 1 per cent. difference."

In the same discussion my friend says "unless it be on some mountain divisions where the weight of the engine is a large percentage of the total train," admitting that under such circumstances the ton-mileage of the engine is a just credit to the motive power department. Accepting this conclusion as correct for mountain roads, remembering that the addition of the engine ton-mileage for prairie roads will not change the comparative results more than 1 per cent., and that the cost for including the engine and way car ton-mileage on a line computing more than four and a half billion ton-miles does not exceed $75 per year, I feel I am justified in concluding that the ton-mileage of the entire train is a fair basis by which to judge motive power efficiency, that the additional cost for this basis as compared with that which does not include the engine ton-mileage is not prohibitive, and that the adoption of the recommendation will be more general than if the engine ton-mileage is not included.

Influence on Design.—As to the claim that the engine ton-mileage should not be included because if this is done, superiority of engine design will fall short of its due reward. The argument was made by a very able designer as follows: "I believe if we can produce an engine with

the same tractive power of lighter weight, the engine is entitled to the benefit of the extra ton-miles it will haul, whereas if we include the weight of the tender there would be no extra credit to that design." A discussion of the argument will show that there is not as much in it as appears on the surface.

The term engine is used so as to include the locomotive proper and the tender. In so far as the locomotive proper is concerned, I believe I am justified in saying that the weight on the drivers determines its maximum tractive power; that the steam pressure and cylinders are so proportioned that their power is a certain per cent. of the weight on the drivers; that this per cent., or tractive coefficient, is seldom below 22 or above 26; that the influence of this narrow margin of variation can hardly be found in the statistics, whether the weight of the engine proper is included in the ton-mileage or not.

Again, the conditions on mountain grades, as compared with prairie lines, should not be lost sight of. On prairie roads the cylinder power may be a larger per cent. of the weight on the drivers than on heavy grades, because under the first-named conditions the maximum tractive power is seldom needed after the train is once under way. But on mountain roads the maximum tractive power of freight engines is used most of the time while going up grade, so that under these circumstances there is virtually no opportunity for superiority of design to produce a lighter engine capable of handling more tonnage, since the tonnage is determined by the weight on the drivers, assuming that the boiler capacity is sufficient. It occurs to me that the following statement is a fair one.

In so far as the engine proper is concerned, there is little opportunity for superiority of design to affect the cost of fuel or repairs, when judged on the ton-mile basis, whether the tonnage of the engine is included or not, though there are a great many opportunities to lighten the weight of the frames and running gear so as to allow larger heating surface and boiler capacity, with the same weight on the drivers.

As to the tender, I believe that it will be granted that its capacity for coal and water is governed by the facilities for furnishing these; that the present tendency is to increase its capacity so as to lengthen the time and distance between stops for coal and water; that therefore the capacity of the tender is almost entirely beyond the control of the designer. This being true, he can show his ability only in furnishing the lightest dead weight for a given capacity. Assume the weight of a tender, having a capacity of 10 tons of coal and 6,000 gallons of water, ready for service, to be 110,000 lbs. The coal and water will weigh 69,800 lbs., leaving 40,200 lbs. as the light weight of the tender. A tender with these general proportions will answer for an engine having 20 x 26 in. cylinders, 63 in. driving wheels and carrying 200 lbs. steam pressure. Such an engine should easily handle 1,500 tons of dead freight on a prairie road. If it does, the light weight of the tender, namely, 20.1 tons, amounts to but 1.3 per cent. of the tonnage back of it; so that, assuming a designer with sufficient ability to accomplish the impossible task of designing a tender with a light weight of zero, he could favorably affect the fuel record but 1.3 per cent., an amount which a two-mile breeze would offset and which we can hardly expect to find in our statistics. In view of these facts it appears to me that we cannot afford to argue in favor of omitting the ton-mileage of our engines, in order that superior designing may not be lost sight of, when the greatest saving we can reasonably expect will be 15 or 20 per cent. of the dead weight of the tenders only.

In my opinion, Mr. Rhodes, in discussing the committee report, struck the keynote as to the correct line of reasoning to follow in reaching a decision as to whether the engine tonnage should be included or not. When discussing the matter, he said: "I believe with the men operating the head end that a great deal of economy can be produced by getting their co-operation and to get their co-operation you must show them figures and results to entirely secure them with you, and you must show them that your figures are fair; that is to say, *that you are measuring these men properly.* I believe that if you leave out a portion of the tonnage that helps to consume the coal and the other materials used on the engine, you are not going to be able to put yourself in a position to say that you are entirely fair in your method of measuring." If it is important that motive power men are judged on a fair basis by their officers, it is at least equally important that motive power officers be judged fairly by their superiors. There is a special point to this argument on divisions and roads where 30 per cent. of the engine mileage is made without even a way car.

I would sum up my argument in favor of including the weight of the entire train in the ton-mileage figures for the use of the motive power department as follows:

The efficiency of the motive power department is measured by the cost of maintenance and supplies per unit of work done. Therefore, the credit should include all the work done.

As to the objections to including the tonnage of the engine: The additional cost is so light that it can hardly be measured.

Inasmuch as the ability of the operating officer is justly measured by the amount of work performed per train and car unit, and not on the cost per unit of work done, and the motive power officer can be fairly judged only on the basis of cost per unit of work done, it follows that the efficiency of both departments cannot be correctly determined by the use of the same measure, and therefore the operating department basis cannot fairly be applied in estimating the efficiency of the motive power department.

While I fully appreciate the great influence of the Mechanical Engineer on the economy of the department and the effect of good and poor designs, I can hardly persuade myself that the basis by which the department as a whole is judged should be made such as to secure the best grounds for giving superior designs due credit, so long as this basis is not a just one for the department as a whole.

There are a few other points in the discussion of the committee report which I wish to briefly review.

While that report advocates the use of the ton-mile basis for "all the items making up the Cost of Engine Service" statement, it was not the intention to advocate the abandonment of the engine mile basis entirely, but leave each line to settle for itself what items should have a supplementary report based on the engine mile. In the paragraph immediately following the table on the first page of the report these words will be found. "We believe it advantageous to also have a statement showing the cost of engine lubricating and illuminating oils on the engine-mile basis."

As to the proper basis for roundhouse labor statistics, I believe this should be the number of engines handled through the roundhouse. This for the same reason that I advocate including the weight of the engine and waycar in the ton-mileage; namely, it gives the cost per unit of work performed.

Track Inspection Apparatus—Car of the University of Illinois and the Peoria & Eastern.

BY E. C. SCHMIDT.*

The apparatus for autographically recording the condition of track here described is in operation on the dynamometer car of the Railroad Mechanical Engineering Department, of the University of Illinois, and the Peoria & Eastern Ry. It was designed in the spring of 1899 by Professor L. P. Breckenridge, and built under his direction, partly in the University shops and partly in the shops of the Peoria & Eastern at Urbana, Ill. It has been in operation at various times since December, 1899, and has now, after numerous changes, been brought into satisfactory working condition, although some further slight changes may be made later. The following things are autographically recorded by the apparatus:

(a). Character of the surface and of the joints of each rail.
(b). Deviations from gage.
(c). Amount of superelevation of rail on curves.
(d). Location of mile posts, stations, roads, etc.
(e). Time intervals.

The apparatus consists essentially of a pair of separate "receiving" wheels," 20 in. in diameter, which are constrained by their weight and by a helical spring to remain continually in contact with the rail and to follow both its changes in surface and in gage. These wheels, through their bearings and their axles, are in communication with three cylinders, whose pistons are made to follow all motions of the wheels due to changes in either gage or surface. These three "receiving cylinders" are, in their turn, in communication, through ¾-in. pipes filled with oil, with three smaller "recording cylinders" located in the car, and whose piston rods carry the marking pens which trace their record on a moving chart.

The greater simplicity of this method has amply justified its adoption in preference to rods and levers. The two or three slight disadvantages incident upon its use have now been satisfactorily overcome. By reference to the accompanying photographs the apparatus may be described in detail, and for the sake of ease of description it will be treated in three parts: The "receiving apparatus," consisting of wheels, cylinders and frame shown in Fig. 1; the "recording apparatus," consisting of cylinders, carriages, guides and pens shown in Fig. 2, and the apparatus for driving the paper chart, shown in Fig. 3.

* Instructor in Railroad Mechanical Engineering, University of Illinois.

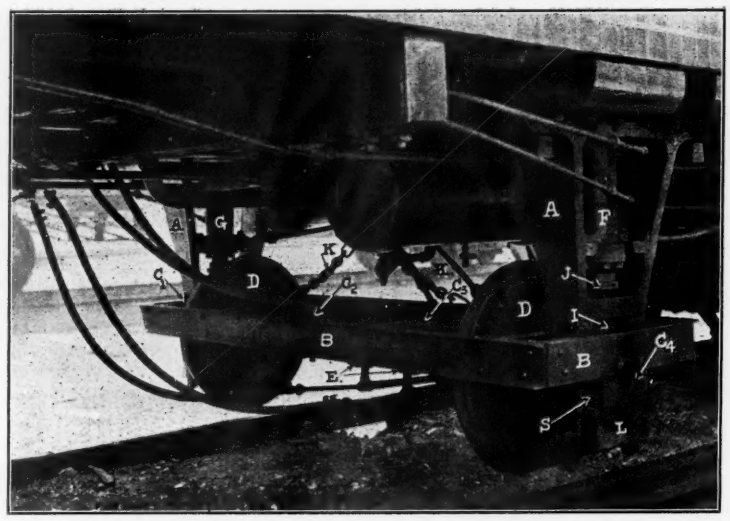


Fig. 1.—Track Inspection Apparatus.

In the photograph, Fig. 1, A A are the supporting frames suspended from the sills in the middle of the car. B B is a light but rigid iron frame to which are fastened, at C_1, C_2, C_3, C_4, the bearings of the wheels D D. The bearings and the frame are free to move vertically in the guides S. Each wheel has its own axle, and these axles extend just inside the inner boxes at C_2 and C_3, and terminate there in collars which limit the outward motion of the wheels.

Interposed between the ends of the axles, and free to slide horizontally on guides fixed in the middle of the frame B B, is a middle cylinder (with piston and rod), which is almost entirely hidden from view in the photograph, by the frame B B; but whose flanges and bosses for pipe connections project slightly below this frame at E. The back end of this cylinder butts up against the axle at C_2, and the end of its piston rod butts up against the other axle at C_3. The end of the piston rod is provided with a collar, and between this collar and the stuffing box is a heavy helical spring which forces the piston forward in the cylinder and, communicating its pressure through the body of the cylinder and piston rod, holds the flanges of the wheels out against the rails. It is evident that any horizontal motion of the wheels causes a relative motion between the cylinder and its piston, and it is this middle cylinder E which receives the motions due to deviations from gage.

The vertical cylinder F, whose counterpart is seen at G on the opposite side, has its piston rod in communication with the box C_4 through a coupling seen at I. J is the stuffing box. The piston in F must follow the motions of the bearing C_4 and the cylinders F and G thus receive all vertical motion of the wheels due to undulations in the surface of the rails, and to high and low joints.

The frame B B, with the wheels, is shown raised from the track. This is accomplished by means of a small air-lift placed below the floor of the car, and whose piston rod takes hold of the chains K K, which are attached to the frame. By this means the rig can be lifted out of action at any time. The blocks L are put in when the apparatus is not in use to prevent its dropping.

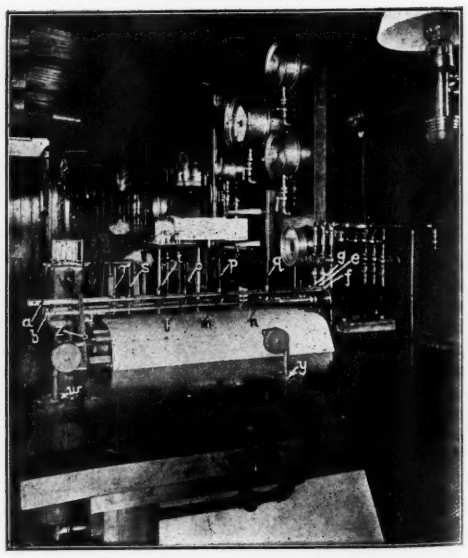


Fig. 2.—Track Inspection Recording Apparatus.

Both ends of the cylinders E, F, G, Fig. 1, are connected by ¾-in. pipe to the recording cylinders e, f, g, Fig. 2, which are located within the car. These pipes contain the oil which provides communication between this receiving apparatus and the recording apparatus shown in Fig. 2. Cylinders e, f, g are bored in one casting, the diameter of the bore being 1½ in., while the diameter of the cylinders E, F, G is 3 in. The ratio of their piston areas is therefore 1 to 4, which is also the

ratio of the sectional areas of their piston rods. The piston rod ends of the smaller recording cylinders are connected to the piston rod ends of the larger receiving cylinders. The motions of the wheels in being transmitted from cylinders E, F, G, to e, f, g, are, therefore, multiplied in this ratio, i. e., a rise of the wheel under F of ¼ in. causes a motion of the piston in f of 1 in.

At q is shown the recording pen which is in communication with the middle cylinder, e. The pen is held in a light carriage, n, which slides upon the guide rods, a and b. This carriage is attached to the piston rod from e, and its pen draws a curve upon the chart showing the changes in gage of the rails beneath. The pens, o and p, are likewise connected through their carriages, l and m, to the pistons of cylinders, f and g, respectively, and they trace upon the chart two curves showing the contour which the surface of each rail assumes under the action of the car. It will be noticed that the three piston rods are reduced in diameter after leaving the stuffing boxes, and are carried through supporting sleeves in the frame over at the left of the chart. A pen, not shown, makes a record of the direction of curvature of the rails and of the amount of superelevation of the

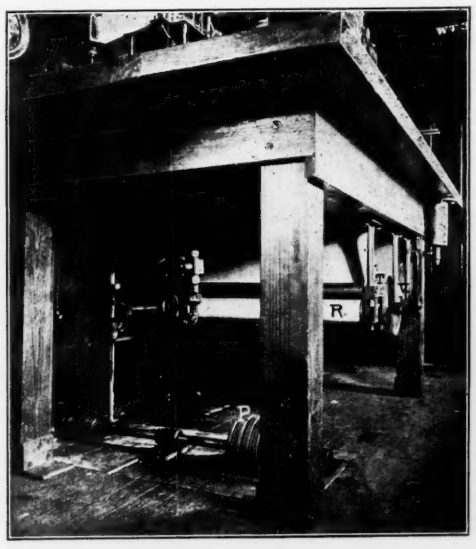


Fig. 3.—Driving Gear.

outer rail on curves. Its carriage is attached by means of two silk cords to two lignum-vitae floats contained in the vertical cylinders w and y, which extend down below the table and are filled with mercury. These cylinders are connected with each other by the pipe shown in the photograph. Pens r and s are used to record the position of mile posts and time respectively. They are moved by electro-magnets located to the left of the chart at z. The mile post pen r is controlled from the observatory by means of a push button, and s is actuated by a clock arranged to make contacts every five seconds.

The chart upon which the record is made is seen in Fig. 2, but its driving gear is best shown in Fig. 3. The motion is taken from the car axle by means of helical wire belts which drive the sheave P, Fig. 3, and this in turn drives the vertical and the horizontal shaft shown over at the side against the wall of the car. The rollers R, driven from the horizontal counter-shaft, grip the paper and draw it between them at the rate of 26.4 in. per mile. V is the supply roller, and T, which is driven by a pair of friction cones, receives the paper after it has passed through R. The paper runs from V up through the table, under the pens, and then down again to P.

Fig. 4 is a diagram showing the arrangement of piping. As previously stated, the receiving and recording cylinders are connected by ¾-in. pipes. All the other piping is simply to either fill or empty these ¾-in. pipes or to provide means of freeing them of air. Compressed air is admitted through valves 6, 6, 6, to clear the oil out of the ¾-in. mains when necessary. Some trouble was at first experienced in getting all air out of these mains. Air vents are now provided at all high points, and these vents, together with the oil return pipes, now permit of the oil being continuously circulated for a considerable length of time through the cylinders and the reservoir before starting, and in this way all air is removed. When the cylinders and pipes are freed of all air, the motions of the pistons and of the recording pens are as positive and definite as though the motions were transmitted by means of solid rods and levers. All the pistons and cylinders are ground to as perfect a fit as possible, the pistons being long and unpacked. The joint between piston and cylinder will stand, without leakage, a pressure much greater than that obtainable in operation.

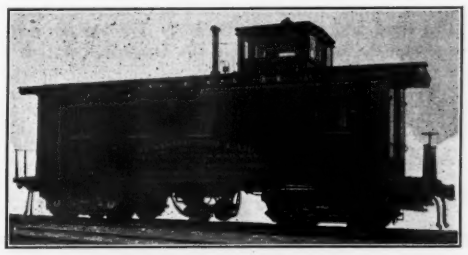


Fig. 5.—Dynamometer and Track Inspection Car.

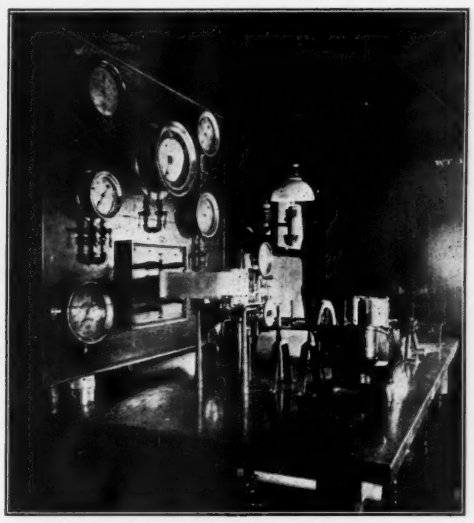


Fig. 6.—Dynamometer Recording Apparatus.

When the car is in use for track inspection, it is raised and blocks inserted in all the springs, so that it is rigid and all motion of the car body relative to the wheels is prevented. This necessitates slow running and for this work the car is run at speeds of from 6 to 15 miles per hour. Fig. 5 is an outside view of the car, and Fig. 6 shows the dynamometer recording gage, the Boyer speed gage, and the various air and steam gages used in dynamometric tests and locomotive road tests. The oil dynamometer was described in the *Railroad Gazette*, Nov. 25, 1898. The dynamometer car of the Illinois Central and the University of Illinois was described by us Jan. 29, 1900.

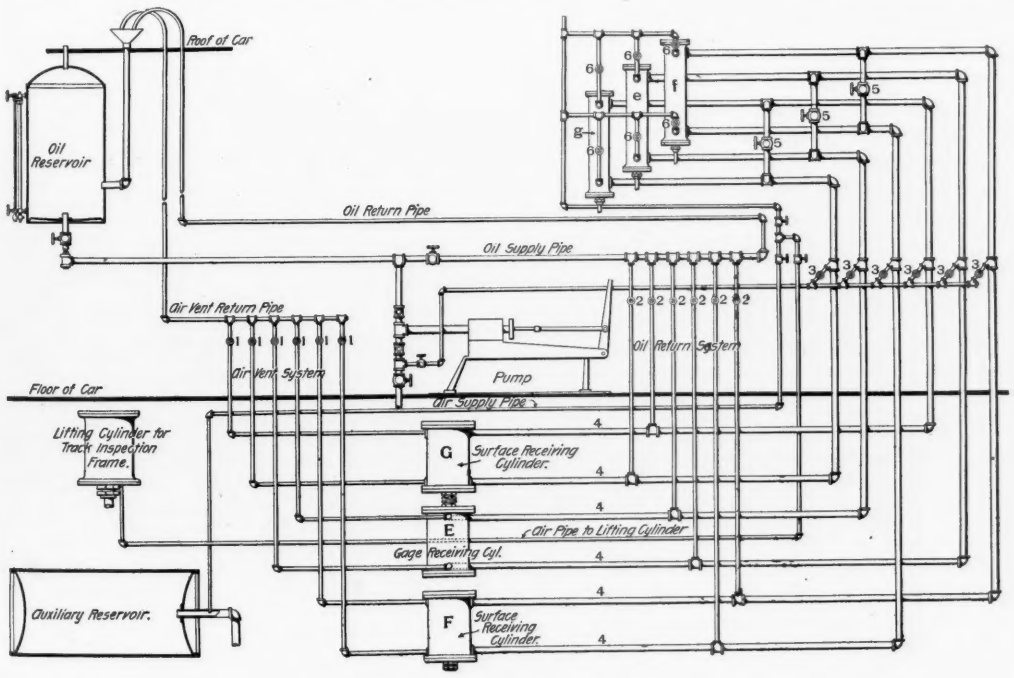


Fig. 4.—Piping for Track Inspection Apparatus.

Fitting Steam Railroads for Electricity.

At the February meeting of the American Institute of Electrical Engineers Mr. Edward C. Boynton presented a paper under the title of "Notes on Electric Traction Under Steam Railroad Conditions." This paper we noticed briefly at the time of its publication. The discussion of the paper at the same meeting is now published in the May issue of the Transactions of the Institute, and we give below considerable extracts from the discussion by Mr. Frank J. Sprague, which appears to us to have been the most interesting and suggestive part of the discussion, so far as the steam railroad man is concerned.

I will take the liberty, if I may, of going back to a review of this subject, and reading from lines written some five years ago, and then make reference to some projects which are now in hand, when I said :

"Electrical development will go on until the trolley system is almost as common as the turnpike. It will establish lines of communication which have not hitherto existed; it will build up new territory; it will act as a feeder to great trunk-line systems, both for passenger and certain classes of freight work; and it will largely encroach upon special fields now occupied by the trunk lines.

"But, when we depart from this class of service and take up what is essentially a trunk-line system, there are many questions to be considered, and not alone those of the local and express service, but also a most important one, which is rarely considered when electric railways are talked of. I refer to the trunk-line freight service—that is, the transportation of goods in great bulk over long distances. One must remember that trunk lines, as they now exist, have been built up by a slow process, and that no very serious change from their existing conditions can be made, considered from the commercial standpoint, except after grave deliberation and at very great expense. Unless passengers and goods can be moved over a system with increased benefit to a community, or at a reduced cost, or with a commensurate return on capital invested, an electric will not replace a steam system.

"It may be said—which is perfectly true—that, if from a central station one can conveniently operate a number of distributed units over a 20-mile road, why cannot two or, for that matter, a dozen such systems be connected together? So they can, but this does not form a trunk-line system. Of course, if we consider the steam trunk-line system from a passenger standpoint, the present system has defects, and the principal one is the inconvenience of service when considering short distances. If one is going a long distance then it matters not so much whether the trains are two or three hours apart in leaving; but long-distance travel and short-distance travel have not the same requirements so far as the passengers are concerned.

"If nothing is sacrificed, it would be preferable, of course, to have smaller units despatched at more frequent intervals, no matter what the distance of travel, but, as I say, this is less important when dealing with long distances than when dealing with short ones. When trains are operated in large units, with comparatively few units between terminal points, and these at considerable intervals, the steam locomotive will absolutely hold its own. When, however, these larger units are broken up, the intervals of train-despatching can be shortened as much as is consistent with satisfactory operation and the number of units distributed over a line made correspondingly large; then, and then only, will electricity be used on suburban lines and lines connecting important cities.

"I have again and again advanced the substance of this statement, and I must here repeat and emphasize this fact—that, so far as passenger service is concerned, considering for the moment only economy of operation, the problem narrows itself down to the number of train units operated between terminal points. Make that number sufficiently large, and the electric motor is the best means of propulsion, whether for high or low speed. Decrease this number, and you must rely upon steam.

"Or, putting it another way, the answer to the query, will electricity take the place of steam locomotive for railway service, is: only in part, and then only when the number of units operated between terminal points is so large that the resulting economy will pay a reasonable interest on the combined cost of a central-station system of conductors and the motor equipment, and the traffic existing is commensurate with the needs of such a system.

"It is perfectly true that looking only at the time standpoint of passenger traffic it is entirely possible and feasible even, not only to operate any existing street or elevated system, and many of the suburban systems, but also the traffic between such points as New York and Philadelphia on a subdivided electric service; but this is not all that is required. The more frequent the units despatched over the track the more exclusive must be that particular track for that particular service, and the larger must be the number of tracks to take care of all the varied service of a great system.

"Briefly, the service may be characterized as the transmission of passengers from one local point to another and the transmission at high speed between principal points—that is, way and express service—and the handling of freight in great masses with all the attendant switching and distribution at way and terminal points. Considering only the transit needs of these various services, a six-track railroad might be considered desirable, and probably would be; but there are many problems connected with such a road, to say nothing of the fact that it would often be impossible to construct such a system on existing rights-of-way. Independent of the matter of investment, rights-of-way, or construction, the problems of switching, passenger landings, and freight acceptance and delivery, on a six-track railroad would be a grave one.

"Freight cannot be handled like live loads. A succession of cars, each with twenty or thirty passengers, might well take care of all the passenger traffic on a road, but freight cannot ordinarily be handled in any such way, except by an

enormous increase of expenditure. The 30, 40, or 50-car train pulled by a single locomotive, with a limited train crew, presents an economical transportation of freight which no system of units on long-distance transportation can hope to equal.

"One of the great advantages of the electric system, as generally used, considered from a traction standpoint, is the fact that the motors are carried under each individual car, or, with few exceptions, under one of two or three cars, thus giving the advantages of a higher proportion of weight for traction, with a consequent distribution instead of localization of weights. When motors reach their highest standard every car can be made an individual unit, which can be operated in any combination and from any point of a train; but this advantage instantly disappears when it is attempted to use an electric locomotive after the manner of a steam locomotive. That is, to put it ahead of a number of car units whose aggregate weight may be from five to twenty-five times its own. It must, then, in a large measure be limited by identically the same laws in the matter of weight and traction as the present steam system. Assuming units which are common on steam roads, such as 1,000 or 1,500 h. p., the enormous loss of energy and the variation of pressure on a line would make the cost, with any possible allowable loss, entirely impracticable."

I have seen little development in the last five years to alter those general conclusions, but I am no less a believer than ever in the gradual and certain encroachment of the electric upon steam railways. If I were asked, however, if electric traction will take place "under steam railway conditions" I would say no, except in special cases. What are steam railway conditions? A more or less perfect roadbed, which gradually becomes a more or less exclusive roadbed, and the more exclusive it becomes the better it is for electric railways; stations at predetermined positions and distances of signaling; operation on the same or on separate tracks of express and local service and freight service, which complicates the problem; operation under a fixed time-table, with varying lengths of trains, but always large units, with a tendency to larger ones. These are essentially steam railway conditions. Many of them are directly opposed to commercially successful electrical operation.

Two things have been brought forward and practically developed in the past three years. The first is the storage battery. Its use on the South Side elevated in Chicago, on which I have 180 cars in operation, the experience on the Metropolitan road in this city, and the general introduction on a large number of other roads and central stations, primarily for the purpose of equalization of load and for taking a small portion of the peak load at certain hours, warrant the statement that it is certain to be a feature in railway development.

Another development is the method of controlling two or more units or cars equipped with motors from a common source, which I have called, and it is now known as the "multiple unit" system, subject to more or less ridicule and criticism during past years, but now being generally accepted as necessary in modern transportation. I do not mean by the term "multiple unit system" the equipment necessarily of every car in a train, but the equipment of two or more cars of a train under a simultaneous control. If there be a question about this latter proposition, let me recite what has been proposed with eight or ten roads representing modern work. The Illinois Central Railway, with its six or possibly eight-track service, stands as an example to-day of the most perfect steam suburban service. For two years and a half at least actively, and for four or five years before that tentatively, its management has considered the application of electricity to that suburban service. Bear in mind that before we undertake the larger problems we must take that which is at hand; that is, suburban service 20 or 30 miles out of the city. So we will consider this Illinois Central road. The conclusion arrived at some two and a half years ago was that from the standpoint of steam economy nothing whatever was to be gained by the adoption of electricity under the conditions which exist in Chicago on that road at the price they paid for coal and with the duty they are getting out of the engines; that in the matter of speed, that was already very satisfactory on the express service, but for the way or suburban service electricity offered an advantage, permitting an increase from 18 to 23 miles schedule speed. But all consideration of a locomotive or a locomotive-car pulling a number of cars has been put aside for a finality. The only thought which they have had in mind is one expressed by the then Chief Engineer and now Assistant First Vice-President Wallace, when he said in effect to me, some two years and a half ago, that he wished to see the abolition of the time-table on suburban service, and to be able to direct at frequent and regular intervals the going out of train units of one or two or ten cars, without unnecessary switching, without a locomotive at the head to pull them, motive power and capacity always holding like proportion to each other, with orders to leave the terminus and get back there as quickly as possible, without waiting at any station for the time-table.

If that road adopts electricity they will put on their cars not less than 300-horse power, and those cars will be operated in any combination from one to a dozen cars. Such radical operation requires, for the best duty, a storage battery to help equalize the load and to take perhaps a little of the peak. If alternating currents are used, with rotary transformers delivering constant potential on the line, it is out of the question to put upon the substations the sharp, varying loads which would be required, without a storage battery.

The Liverpool Overhead Railway operates at present three-car trains, with motors on the front and the back car. The Waterloo and City Railway of London operates three and four-car trains, with motors on the front and back cars. The Union Electric Company of Berlin has recently submitted a project to the Minister of Public Works proposing the change over from the present steam system to an electric system, working as many as 12 cars in a train, each car being equipped with two motors of 150 horse power capacity each. The new Berlin Elevated Railway, of which Messrs. Siemens and Halske are the prime movers, are considering the operation of four and five and even up to ten-car trains, and they have had under consideration all sorts of methods—four-car trains, with three motors on the front and on the back car; four-car trains, with four motors on the front and back car; five-car trains, with two motors on the front and back car; ten-car trains, with two motors on the first and rear car and two motors on a middle car, and a full multiple unit system.

The new Boston Elevated road will have an equipment of two 150 horse power motors per car and operate them in from two to five or six-car trains, all under a common control. The Manhattan—well, none of us can speak with any definiteness about that yet, and therefore I will not prophesy.

The Brooklyn elevated will operate from three to five-car trains, with two and three motor-cars in a train, and contemplate eventually equipping every car, all under a common control. So it would seem that in electric railways the idea of grouping together units and controlling them from a common point is the accepted engineering conclusion, no matter who does it or what the specific apparatus. If a railroad is operated either with one-car units or two-car units or six-car units all the while there would be a definite determination of the motor equipment for that unit. If instead of being constantly operated with one size train units, it is operated with trains which are made up of a varying number of units, then it seems reasonable to suppose that each of those units should be equipped with the power and only with the power that is necessary to drive them.

I have often to take the Delaware, Lackawanna & Western Railroad. I picked up a time-table this afternoon, and I was a little surprised at some of the conclusions which a graphic setting out of that time-table showed. At present one crosses the ferry every 10 or 15 minutes and finds a train every 40 minutes or every hour and 10 minutes. The aggregate roadway here considered is roughly 34 miles, and the actual single trackage about 66 miles. Between about 5 o'clock in the morning and 1 o'clock at night there are 144 trains in operation on either a part or the whole of the distance over those lines from Hoboken to Montclair, or to Morristown, 31 miles away, leaving out those trains which go beyond Morristown. I have considered their limit of service because it is within the reasonable limits of transmission of an alternating current from a reasonable center. Perhaps it would suprise you to know that despite that number of trains there are times—considering no stoppages whatever at a station, but only the time from departure to arriving—between 5 o'clock in the morning and 1 o'clock at night when there is only one train on this 66 miles of track. That is a steam railroad condition, but not one which w ever be adhered to if the road adopts electricity. Considering the stoppages of trains at the different stations, there are probably not less than 20 times during these hours in which there is not a car moving in all those 144 trains that operate within the 30 mile radius of Hoboken—not less than 20 times within the day when there is not a wheel turning on 66 miles of track, despite the fact that this road is supplying 20 or 25 populous suburban towns. It has been said that that road is considering the adoption of electricity. It is a perfectly practicable engineering problem and entirely feasible commercially. As at present run there are but from 1 to 13 trains in service, and from about 3 to 65 cars maximum.

The equipment to get the best service should be with not less than one-half of its cars equipped with motors, and I question if it would not be better if every one of its passenger cars were, but certainly not less than one-half.

If one-half of the standard coaches on a road were equipped with motors under conditions that would make it possible to operate two or a dozen cars under simultaneous control, the cost of the car equipments would probably not exceed one-quarter the cost of a single one of the generating units required for the Manhattan Railway, including its engine, steam piping, and proportion of building. The power required to operate this 34 miles of suburban road would be equal to about two of the Manhattan units, and but very little more than is being used on the South Side elevated in Chicago.

It seems to me that the broad question of using electricity on a road is one which is to be determined absolutely by the frequency of service which that road will stand, and the more the short-distance trains are operated electrically the fewer the steam trains going to long-distance points, which must operate over that road. I will content myself by simply prophesying two facts; one is that the storage battery is a necessity in any large development of the application of electricity to railroads, and the other, that the aggregation and control of two or more units in a train—that is, the multiple unit system will be the future method of operation.

The South Side road in Chicago, of which I have spoken, was a steam road operated by Baldwin 28-ton compound locomotives, hauling from two to five cars. The saving at the present time is about $500 a day for coal alone. They are also saving in transportation expenses. The actual cost of the operation of the road, exclusive of taxes and licenses, is 7½ cents per car mile of 22 tons average weight, including passengers, and stopping at intervals of about 2,000 feet, on a schedule of 15 miles an hour.

No one here has spoken of the somewhat interesting experiment made in Germany on long-distance transmission. Mr. Reichel, the Chief Engineer of the Siemens & Halske Co., was here a short time ago, and he told me of some experiments he had carried on in the transmission of an alternating current at 10,000 volts over a small line, from which the current was taken directly to the locomotive, on which was a transformer, connected with which was an alternating current motor. His object, of course, was the reduction of the cost of transmission for spasmodic service over long distances, and with a small arc of contact to get a large amount of energy from a small overhead wire. I do not know how successful the experiment was, but it at least was tried. But on the new Berlin elevated railroad they are going to use the continuous current at 700 volts.

I notice, speaking about the cost of some things, that $80 to $90 was given as the cost of the central station per kilowatt output. The cost in the stations laid out in this city at present is over $200 per kilowatt, including engines, dynamos, switchboards and such proportion of the buildings as is required to cover that particular unit. There has been some rise in prices in the matter of machinery recently.

As to curves and grades, the Manhattan elevated and the Brooklyn elevated are almost identical in their conditions, and require about the same energy per ton-mile for any given schedule. On a six-car train, a schedule of about 13½ miles an hour, when the train is loaded, is barely possible with a locomotive car weighing about 40 tons equipped with four motors of the largest size which are practical to put under a car. They would be rated at 600 horse power, but that is excessive rating, considering the thermal characteristics, and they could not stand the service. If instead of the proportion of weights on the drivers that that locomotive would give, these six cars are equipped, each car with two 80 horse power motors, it would be perfectly possible to go to a 16½-mile schedule, or if equipped with two 50-horse power motors, making the same aggregate motor capacity on a six-car train which it is possible to get with a locomotive car, a 15-mile schedule can be made with the distributed motor equipment, with identically the same power at the central station as would be required to make a schedule of 13½ miles with the 600-horse power localized on one car.

If the schedule of 13½ miles were only required with the distributed motors, there would be a reduction of about a million and a half dollars in the cost of delivering current to the car-shoe.

These are briefly the results of a good many calculations which have been made with reference to roads with these particular conditions. The reason is that there are three kinds of work; lifting of a car on an up-grade, which is independent of the schedule, simple traction, which is so much per ton, and is also perfectly independent of the schedule, except as the air pressure affects it; and inertia, which is put into a car and thrown away in braking. If you can get a car up to a certain speed, cut off the current, and then coast to a stop, it would be just as well to run the car that way as to go to some less speed, then run along at a constant speed, and coast without any braking to a stop. The energy put in car for the purpose of getting up speed varies as the square of the speed, so that the difference in inertia energy between 20 and 25 miles is as 400 to 625. Under the conditions existing on the elevated railroads here and in Brooklyn, and for quite a range of schedules, the energy per ton-mile varies nearly as the cube of the schedule speed. It runs up rather rapidly. About the most economical speed with the existing station distances stops and grades is about 16 miles.

Keeping Up Line and Grade.

A short time since I was called on to make a survey of a tract of ground which bordered the main line of one of the lines of the A. B. railroad. The line at that point was described on the map as a ten degree curve, and my calculations went wrong there. I checked up the curve, and found it to vary from 4 deg. 30 min. to 13 deg. at different points of its length. I shall not locate this place as there had been a wreck at this point and I am neither procuring evidence for a damage suit against the company nor a bulletin against the section foreman. There had been a trestle filled at this point, I think, and the track had never been lined up with an instrument after that.

A year ago I was making a survey for a connection with the main line of the C. D. and ran some levels over a stretch of their track near a summit approached by a very long maximum grade supposed to be 1 per cent. At the summit for seven stations I found the grade to vary from 1.3 ft. to 1.7 ft. per station. I later inquired at the engineer's office about this spot and found that grades had been run on this particular hill with much care and that it was supposed the grade was uniform, but they told me the engineer department had no power to enforce obedience to their grades and it was a common thing for the trackmen to ignore them.

This called to my mind an experience which I had on another overland road where trestles had been filled in under a previous management and tracks laid without any transit lines being run. We were laying new steel and lining up all track as laid. The alignment was found to

be so bad that the superintendent ordered that centers should be run on all track whether new steel were laid or not, and the track brought to line, and also that levels be run and track be surfaced to such a grade as would eliminate small sags and better the greater ones. When this was done it was found desirable to re-rate all engines, and a satisfactory increase was made in the earning power of the engines.

Now I may be thought to be making a plea for my profession, so will recount another observation, this time on the E. F., a road where the civil engineer is in authority. A very handsome-looking piece of rock ballast was found to ride badly, and on being looked into was found to be a surface dressing merely, with no particle of the rock under the ties.

The roads I have named are roads of high class, and the presidents are exceptionally able and honest and are endeavoring to bring their roads to a high standard. They have each done much to that end, and are no doubt somewhat disappointed at the apparent lack of results from some of their improvements.

Experience has shown us that trackmen will try to make a record for low cost of the work of their division. The trackman on the A. B. would not widen the bank although his string showed him that his curve was irregular, because that would add to cost, and he could not tell but it would lead him off the right of way. A competent transitman would have fitted a curve to the bank that would have been regular throughout its length, and added much to the safety and easy riding of the trains. Had the Resident Engineer possessed the authority, and been the right man, that grade on the C. D. would have been finished to a true grade, and would not have been the limiting grade of the division to as low a limit as it was at least. In the case of the E. F. I am inclined to think that if the annual examination went a little deeper, and gave a very black mark to galvanizing, such instances as I cited would disappear.

A large sum annually is lost on the roads above named from the lack of rigid oversight of the matter of track alignment and grades. It is out of all proportion to the petty saving made by limiting or dispensing with the civil engineer. But a civil engineer is not of value simply from ability to handle an instrument and set a stake. In both grades and alignment an engineer can show the highest quality of judgment. He can increase the cost of doing the work to an extent that makes it undesirable, by adhering to a conceived grade or curve, and cause the "practical man" to discard him altogether. A cheap engineer is worse than none. He should be a man with a mind great enough to see the larger problems of operation, and fix all his work to accomplish this end. He should be a man who will use a dollar if he can not get twenty, and will use it all so it works to a definite purpose, and accomplishes something permanent toward that end.

Birmingham, Ala. VAN A.

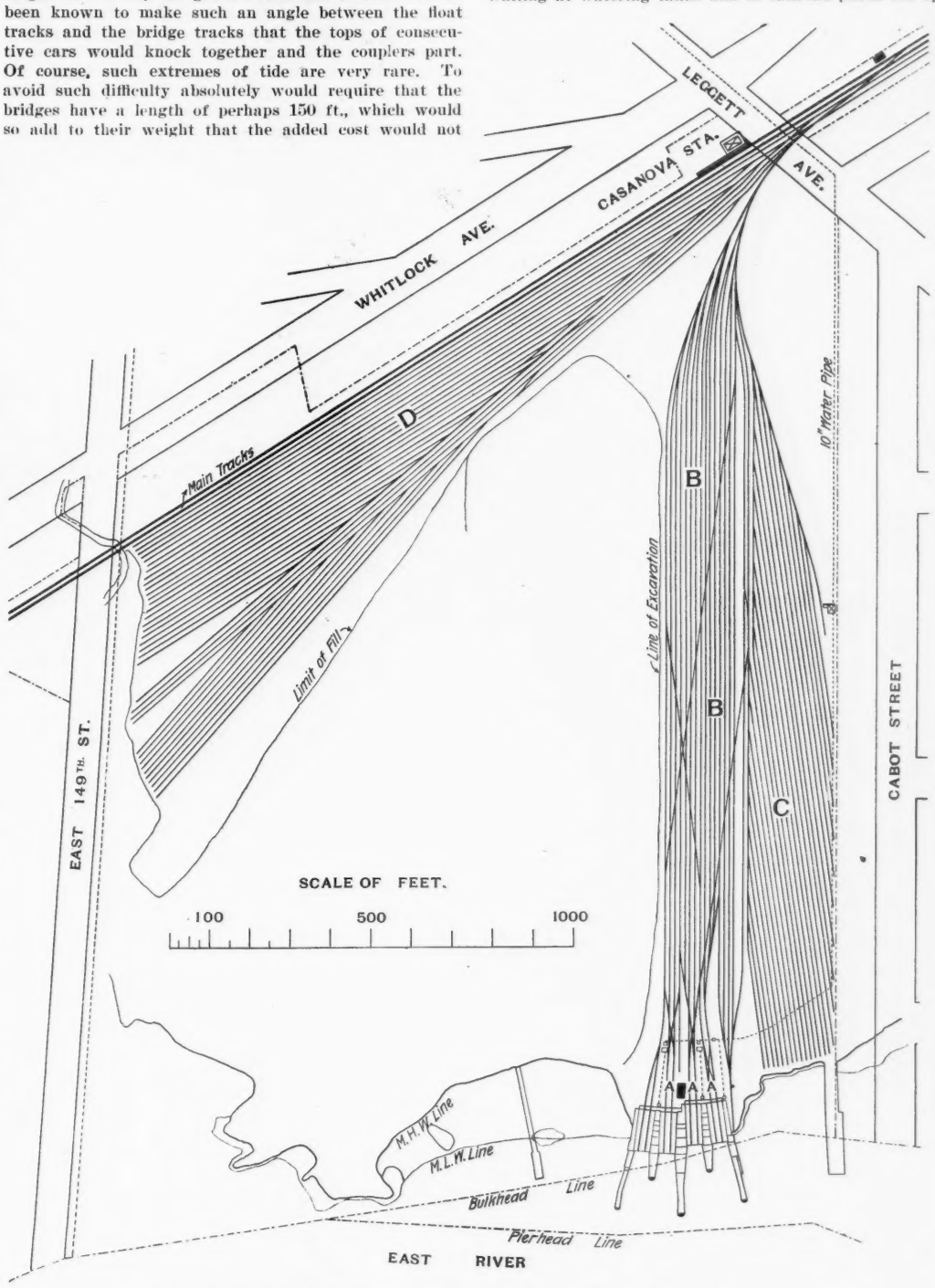
Oak Point Yard—New York, New Haven & Hartford.

The freight traffic on the New York, New Haven & Hartford has increased from 200,000,000 ton-miles in 1891 to 900,000,000 in 1898, and naturally the freight terminals established in 1876 at Harlem River Yard have become inadequate for their work. Foreseeing the necessity for enlargement, a large tract of land at Oak Point has been gradually acquired, and early in 1899 plans were completed and the work begun for the yard, which is shown in the accompanying sketch. The grading involved the excavation of about 200,000 cu. yds. of earthwork, of which about one-seventh was rock. The excavated material was utilized in filling the low swampy parts of the tract. The yard contains about 21 miles of track. Excluding the leaders and poling tracks, the maximum capacity is 1,929 cars. Two pairs of transfer bridges, capable of receiving 20 car floats complete the plant, which required a total expenditure of about $400,000, exclusive of the cost of the land—approximately $1,000,000 more.

The ultimate design of the road is to extend the four-track system from New Rochelle, the junction of the Harlem River Branch with the main line, to the Harlem River. The four tracks have already been completed from New Rochelle to Pelham Manor and their extension, at least as far as the Oak Point Yard, is probably a work of the near future. The yard work was completed last January.

As usual, the construction work developed some special difficulties. The channel between the shore and North Brother Island is narrow but very deep. The tide sweeps through the channel with such velocity that bed rock is either swept bare or is covered with but a few feet of mud. Even the rock bottom is so sloping that although it has the level of about mean high water at the shore end of the "bridges," it is 50 ft. deep at the outer end of the piers. The shore ends of the piers were constructed of cribwork, and the problem of settling the cribs satisfactorily on the rough shelving rock bottom was no small part of the work. After the sites for the cribs had been roughly leveled off, the cribs were floated into place and sunk with stones placed in the inner pockets. The outer pockets had no bottoms. It was calculated that stones thrown in the outer pockets would fill up all low places in the foundation and make a sufficiently good bottom. The forces against the cribs are assumed to be lateral rather than overturning, which justifies the above method. Outside of the cribs the rock drops off rapidly to a depth of about 50 ft. at the ends of the piers and to even 100 ft. in the channel. Permission was obtained from the United States Government to fill in the site of the piers with rip-rap up to 30 ft. in depth. Piles were driven into this rip-rap. Oak piles were chiefly used, but spruce piles were employed for the inside piles of the clusters. Pile shoes were not used.

Although the mean range of the tide is about 6½ ft., a total range of 12 ft. is not unknown. The track at the shore end of the bridges is about 3 ft. above mean high water. This level was decided on after an extended series of tidal observations made to determine the elevation of mean high water at that point, and the extreme tidal range. The transfer bridges are about 100 ft. span, and are made of steel. At the shore end they rest on shoes placed on wooden cribs of squared timber. At the channel end they are supported on pontoons. Hoisting cables, controlled from the bridges, adjust their heights to the car floats. Even with their unusual length of 100 ft., the great fluctuation of the tide has been known to make such an angle between the float tracks and the bridge tracks that the tops of consecutive cars would knock together and the couplers part. Of course, such extremes of tide are very rare. To avoid such difficulty absolutely would require that the bridges have a length of perhaps 150 ft., which would so add to their weight that the added cost would not be justified to avoid an occasional delay which may happen a few times each year.



The Oak Point Freight Yard of the New York, New Haven & Hartford Railroad.

A special feature of the tracks (A) immediately above each bridge is the set of X switches which has been found to greatly facilitate the transfer of cars to and from the floats. This feature has already attracted the attention of many railroad men, and has been much commended. The contraction of the right-of-way where it crosses Leggett avenue required some compensating facilities within the yard, and these were furnished by the peculiar combination of the leader tracks in the yard above the bridges. The tracks (B) between the leaders are each long enough for one float load—20 cars. From here each float load may be drawn to the adjoining drill and storage yard (C) and drilled for division or local distribution. The large drill and storage yard (D) adjoining the main tracks may be similarly utilized. When cars have been drilled ready for shipment on the floats, they may be grouped in batches of 20 or less on the tracks (B), from which they are easily led to the floats when desired. The work has been under the immediate charge of Mr. W. J. Black, Division Engineer. WALTER LORING WEBB.

Railroad Police and the Tramp.*

The train jumpers, or the hoboes, as it seems best to call them in this paper, are distinctly an American product. They have come among us mainly during the last thirty years. If, at this time, the railroad companies had got laws passed such as are in vogue to-day in Great Britain and on the Continent, forbidding any one but an employee walking on railroad property, save at public crossings, we should have learned ere this to obey them, and the railroad tramps would not be with us. Taking this country, by and large, it is no exaggeration to say that every night in the year 10,000 free passengers of the tramp genus travel on the different railroads in the ways mentioned, and that 10,000 more are waiting at watering tanks and in railroad yards for opportunities to get on the trains. I estimate the entire professional tramp population at about 60,000, a third of whom are generally on the move.

A serious loss to the railroads is that involved in the disappearance of goods undergoing transportation and in claims for personal injuries. Professional thieves frequently become tramps for a time, both to minimize their guilt and to elude capture, and the probability is that the majority of the greater thefts are committed by them. That railroad companies should have to reimburse trespassers for the loss of a hand or foot while riding unauthorized on trains, will strike everyone as a very unjust tax on their resources, but this is continually happening. To tell all that the country at large suffers from the free railroad transportation of tramps would take me beyond the limits of a paper of this character, but there are a few facts which must be stated.

* From a paper by Josiah Flynt before the annual meeting of the Central Association of Railroad Officers at Louisville, Ky., July 17, 1900.

In the first place, the railroads spread the tramp nuisance over a much greater stretch of territory than would be the case if the tramps had to take to the turnpikes. There are districts in the United States which are so difficult to reach by the highroad, on account of unprofitable intermediate territory, that the hobo would never attempt to go near them if it were not easy for him to get over the disagreeable parts of the journey in a box car. All this contributes to making it difficult to locate and capture the dangerous characters in tramp life, and many professional criminals, who have nothing to do with beggars in other quarters, are mixed up with them in freight cars. The railroads also help to keep the tramp element in our large cities. It very seldom settles in the country, and not for any length of time in provincial towns. New York, Chicago, Philadelphia, Boston, San Francisco, Buffalo, Baltimore, New Orleans and other like places are its main strongholds. The more the criminal element of a country fastens itself upon its cities the harder it is to break up, and in the United States this is what is taking place. Chicago, for instance, is as much a center in the criminal world as it is in the business world, and almost every freight train entering it brings a contribution to its criminal population. There is one more point which cannot be overlooked: the temptation the railroads have for a romantic and adventuresome boy. A child possessed of Wanderlust generally wanders for a while anyhow, but the chance he now has to jump on to a freight train and "get into the world quick," as I have heard lads of this temperament remark, has a great deal to do in tempting them to run away from home.

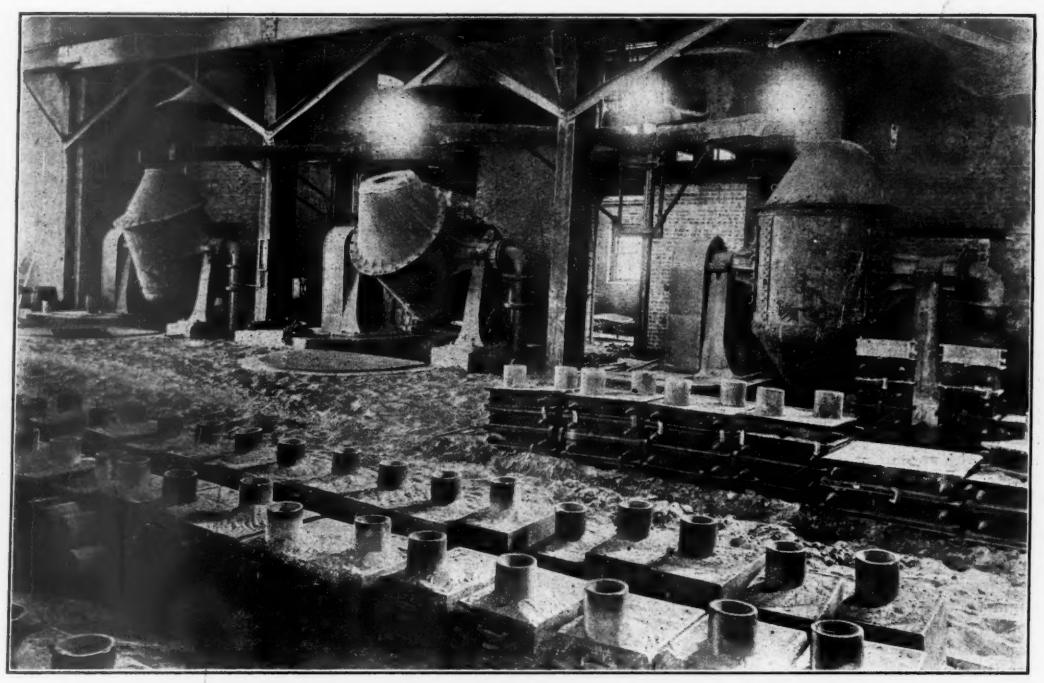
Can the tramps be driven off the railroads? Up to date the difficulty in answering this question in the affirmative has been that railroad companies have been afraid of the cost, and consider it cheaper to put up with the tramps than pay the bills. It has at last been demonstrated, however, that vagabonds can be refused free transportation by one of our greatest railroads with a saving of expense to the company and with great benefit to the community, and I cannot better illustrate the usefulness of a well-organized railroad police force than by giving the history of the police service in vogue on the railroad in question. I refer to Pennsylvania Lines West of Pittsburgh, the police force of which, in inception and direction, is the achievement of the General Manager of this system. [This admirable work has been repeatedly described in the *Railroad Gazette*.]

If all the railroads would take concerted action against tramps, in a few years the following very satisfactory results would be achieved: First, very few tramps, if any, would try to beat their way on trains; second, an appreciable number of them would give up tramping altogether, because their present railroad privileges are to many the main attraction of the life; third, a few would try to do pure criminal work again, partly out of revenge and partly because tramping on the turnpike would be too disagreeable; and, fourth, a great many would take to the highways where some might be made to do farm work, and where all would at least be in touch with farm life. Exception may be taken to the third on the ground that great harm would come of an increase in the professional criminal class, but, as I have said, tramps are really discouraged criminals, and a return to the old life of which they made a failure would only land them in the penitentiary.

New Steel and Iron Foundry of the Sargent Company.

Since the first of February, the Sargent Company has been operating its new steel and iron foundry at Chicago Heights in addition to its old works at Fifty-ninth and Wallace streets, Chicago, which, with the exception of the iron foundry, it will continue to run. In the old Fifty-ninth street works there is now one acid open-hearth furnace, the capacity of the plant being about 40 tons of steel castings a day. The new Chicago Heights iron foundry has two cupolas capable of melting 60 tons of metal a day, while in the steel foundry there are three Tropenas converters, each rated to make 24 tons of steel a day. The capacity of the company for turning out both iron and steel castings has been more than doubled.

The Chicago Heights plant may be considered a model foundry. The buildings are brick with stone trimmings. The iron and steel foundries are in two parallel buildings, 200 ft. long with an open court between, the foundries being connected at the north end by a building at right angles. In the court are switching and shop tracks by which materials are brought in and unloaded where they are to be used. As all the machinery is driven either by electricity or compressed air, the power house is a separate building well away from the foundries.



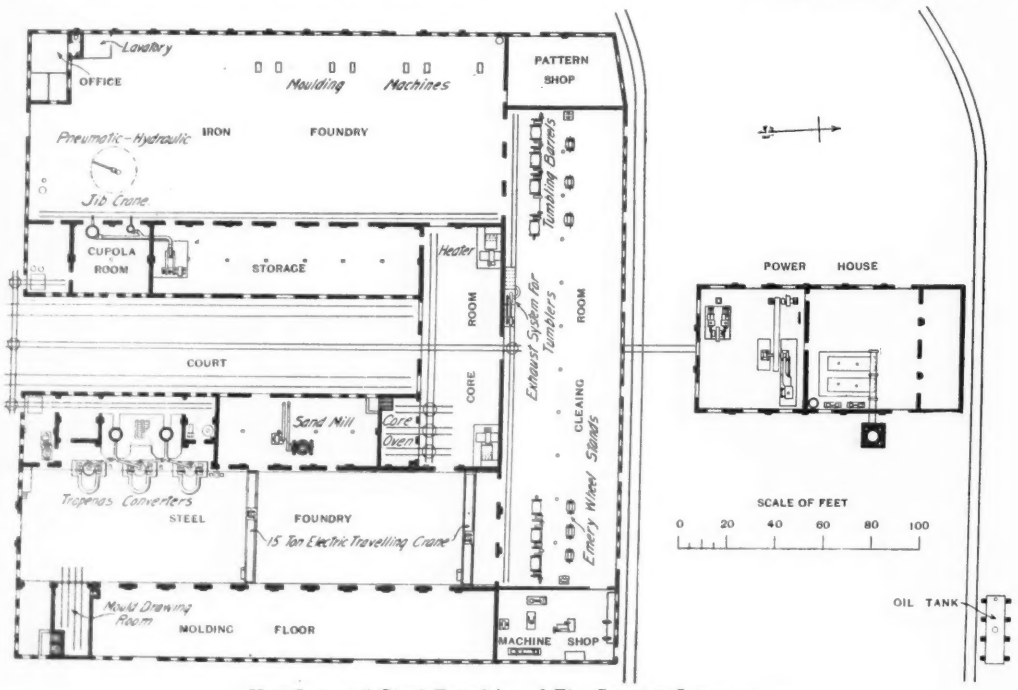
Tropenas Converters in the New Sargent Foundry.

The molding floor of the iron foundry is 80 ft. wide and this building has side walls 18 ft. high and a deck roof and ample light. Materials for the cupolas are brought in on push cars from the adjacent yard and by an elevator they are raised to the charging platform. For handling the large ladles, into which the iron is tapped, a pneumatic-hydraulic jib crane is placed in front of the cupolas. From the large ladle the metal is poured into ladles mounted on a truck holding about 250 lbs., which run on a longitudinal track at the side of the room. From these smaller ladles are filled which are used in pouring the molds. The small ladles are mounted on two-wheel bogies so as to swivel and these are run in transverse aisles between the molds, the aisles being paved with cast iron plates. Only one man is required to handle the small ladles in pouring and the work is much lightened by the use of the bogies.

In the steel foundry, the converters and sand mill are next the court and the casting floor is 50 ft. wide and served by two overhead electric traveling cranes, each of 15 tons capacity. There is a clear head room under the cranes of 19 ft. Along the side opposite the converters is a one-story addition used for molding. Both foundries are served by a single cleaning room at the north end, with electrically driven tumbling barrels and emery wheels, and the dust in this room is carried off by forced ventilation. The shipping track is just outside the cleaning room and the floor of the cleaning room is on a level with the floors of cars.

A duplicate plant could be added at the southern end and this extension could be made without disarranging the present buildings, or the present plan of handling materials. The company owns 18 acres of land, with ample room for future extensions and has a connection with the Chicago switching roads.

The power house is equipped with two Brownell tubular boilers, 18 ft. long by 72 in. in diameter, and an 18 x 42 in. Reynolds-Corliss engine, belt-connected to a 150-k. w. generator. The air compressor is a duplex compound with a capacity for compressing 700 cu. ft. of free air a minute. The stack is brick and 100 ft. high.



New Iron and Steel Foundries of The Sargent Company.

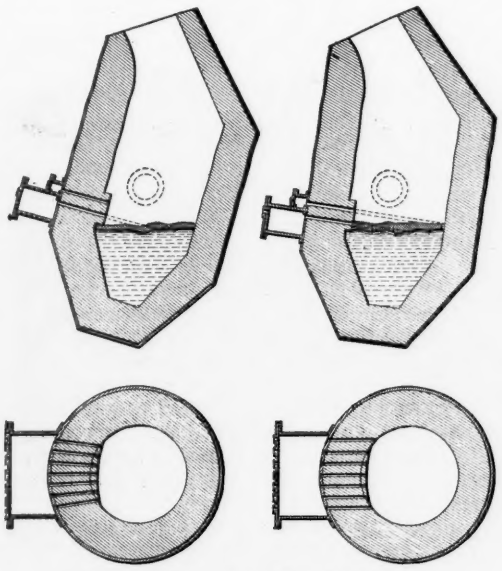
Oil is used for fuel in the heaters and ladles, and this is stored in a tank of 10,000 gallons capacity located at a distance from the buildings. A spur track runs past the boiler room and oil tank so that coal and oil can be unloaded from cars where it is to be stored. Electricity is used for lighting, for driving the traveling cranes, the tools in the machine and pattern shops, the sand mill, emery wheels, tumbling barrels and the converter and cupola blowers. The smaller cranes, hoists and elevators are worked by air.

The Tropenas Process.—Probably the chief feature of interest is the Tropenas process of making steel which is now being introduced somewhat extensively in Europe and in a few places in this country. There are three converters, each of 24 tons capacity, which is the largest installation of the kind in this country, the converters being shown by the engraving from a photograph. The process is especially adapted to foundries making castings varying greatly in size, and for such work it has decided advantages over the open-hearth process. The steel comes from the converters much hotter than from an open-hearth furnace and can be poured in much the same way as cast iron. With the converters working, pouring can be carried on almost continuously. On the other hand with the Tropenas process it is not so necessary to operate the plant uniformly as the process lends itself better to fluctuations in orders. In the present case the Tropenas converters will be run as an adjunct to the open-hearth furnaces in the Fifty-ninth street plant enabling an important class of work to be done which heretofore could not be carried on economically. It is intended that most of the castings at the new works shall be made in green sand molds.

The pig metal in this process is melted in cupolas, there being two cupolas for the three converters mounted on an elevated platform as shown, so that the fluid metal flows by gravity through troughs into the converters. A charge consists of about 5,000 lbs. The converters are sheet steel shells lined inside with refractory bricks, or gannister. Each shell is fitted with two hollow trunnions carried on two pedestals so that the apparatus may be tilted according to the requirements of working; that is, charging the pig metal, pouring the steel or blowing. The inside of the converter is so arranged that the metallic bath has a greater depth or thickness than in other pneumatic processes. At the rear and in a plane parallel to the axis of the trunnions are fixed two wind boxes, connected by a conduit to the hollow trunnions which are in communication with the blowers. These two wind boxes are independent of each other as shown by the line drawings. Inside of the lower box a row of horizontal tuyeres terminate which open into the converter high enough to be always above the surface of the bath. In the upper wind box and above the lower tuyeres is a second row of tuyeres which are flattened so that their free section is about three-fourths that of the lower tuyeres, and all

are so placed as not to cause a gyratory motion of the bath.

When a charge of melted pig has been run into the converter, it is turned up so as to bring the lower tuyeres near the surface of the metal but above it. Then blowing is commenced in this position and continued until the carbon flame appears. When the operation is well under way the top tuyeres valve is opened so as to admit a supplementary quantity of air. This air unites with the escaping gases and produces a zone of high temperature which, by radiation, considerably increases the heat of the



Tropenas Converters—Showing Tuyeres.

charge. The operation is stopped when the flame disappears, the time of blowing being about 20 minutes. The metal is then extra soft steel and recarbonization is made by adding in the converter silico-spiegel and ferromanganese, which is heated red-hot in a heating furnace. The quantity added determines the quality of the steel. The blast pressure per square inch required for good working is from 3 to 4 lbs. The pig iron which can be used with this process must be low in sulphur and phosphorus. Each operation in the converter lasts from 18 to 22 minutes and when the time required to pour and recharge is included the average time for a complete operation is about 30 minutes. At Chicago Heights the metal is run from the converter into large ladles, holding about 2,500 lbs., which are handled by the traveling cranes, either to pour directly into the molds or into smaller ladles depending upon the nature of the work. With two overhead cranes and all the converters in use the pouring gang is constantly working.

Diagonal Bracing Over the Turntable in Swing Bridges.

BY MALVERD A. HOWE, C. E.

The proper proportions for diagonals in the rectangular panel over the turntable of swing bridges of the type shown in Fig. 1 have never been definitely fixed by bridge engineers. Some put in "light diagonals" of arbitrary cross-section, others design them to take a certain amount of vertical shear, while a few leave a shallow unbraced rectangle at the top and put in diagonal bracing below; in all cases the method employed in the determination of the dimensions used appear to be purely arbitrary. Fortunately the effect of diagonals however designed is of small moment as will appear from the following discussion.

Let A B E F represent the rectangular panel over the turntable with the pins at E and F fixed in position. This assumption, relative to the pins at E and F, is not strictly correct but the relatively large amount of metal between E and F precludes any but an exceedingly small change in the distance E F which can be neglected.

Fig. 1.

If symmetrical and equal forces be applied at A and B, what will be the stress in S_3?

From Fig. 1:

$$S_2 = V + S_3 \cos\theta$$
$$S_4 = H - S_3 \sin\theta$$
$$S_5 = 2\,S_3 \sin\theta$$
$$S_6 = S_3 \frac{\sin\theta}{\sin\beta}$$
$$S_7 = V + S_3 \frac{\sin\theta\cos\beta}{\sin\beta}$$

The above *five* equations contain *six* unknowns, hence another equation is necessary before the problem can be solved. This is supplied by the fact that the stresses will so distribute themselves among the different pieces that the *work performed in distortion will be a minimum*, or the magnitudes of the stresses must be such that the following equation will be a minimum:

$$\text{Work} = \frac{1}{2E}\{2\,S_2^2\,m_2 + 2\,S_3^2\,m_3 + S_4^2\,m_4 + S_5^2\,m_5 + 2\,S_6^2\,m_6 + 2\,S_7^2\,m_7\}$$

E = Young's modulus of elasticity, assumed constant.

$$m_2 = \frac{l_2}{a_2} = \frac{l_3\cos\theta}{a_2} \qquad m_3 = \frac{l_3}{a_3} \qquad m_4 = \frac{l_4}{a_4} = \frac{l_3\sin\theta}{a_4}$$
$$m_5 = \frac{l_5}{a_5} = \frac{l_3\sin\theta}{a_5} \qquad m_6 = \frac{l^6}{a_6} = \frac{l_3\sin\theta}{a_6\sin\beta}$$
$$m_7 = \frac{l_7}{a_7} = \frac{l_3}{a_7}\frac{\sin\theta\cos\beta}{\sin\beta}$$

a and l = area and length of pieces designated by the subscripts.

Substituting the values of S_2, S_4, etc., differentiating, placing the first derivative equal zero and solving for S_3 its value is

$$S_3 = \frac{\frac{H\sin^2\theta}{a_4} - \frac{2\,V\cos^2\theta}{a^2} - \frac{2\,V}{a_7}\left(\frac{\sin\theta\cos\beta}{\sin\beta}\right)^2}{\frac{2\cos^3\theta}{a_2} + \frac{2}{a_3} + \frac{\sin^3\theta}{a_4} + \frac{4\,\sin^3\theta}{a_5} + \frac{2}{a_6}\left(\frac{\sin\theta}{\sin\beta}\right)^3 + \frac{2}{a_7}\left(\frac{\sin\theta\cos\beta}{\sin\beta}\right)^3} \quad \ldots(1)$$

This is the true value of the stress in S_3, under the assumptions made in the beginning, and this substituted in the expressions for S_2, S_4, etc., will give the true stresses in these pieces.

If the diagonals are in two equal panels one above the other, $\theta = \beta$. If the diagonals are uniform in section $a_3 = a_5$. If the vertical posts are uniform in section $a_2 = a_7$. If these three conditions exist then equation (1) reduces to

$$S_3 = \frac{\frac{H\sin^2\theta}{a_4} - \frac{4\,V\cos^2\theta}{a_2}}{\frac{4\cos^3\theta}{a_2} + \frac{4}{a_3} + \frac{\sin^3\theta}{a_4} + \frac{4\sin^3\theta}{a_5}} \quad \ldots(2)$$

To show the effect of the area of S_3 upon its stress and also the corresponding effect upon the stresses in other members let H = 0.932 S_1 V = 0.369 S_1 a_4 = 30 sq. in. a_5 = 10 sq. in. a_2 = 40 sq. in. and θ = 45°.

If these values be substituted in equation (2) it becomes

$$S_3 = \frac{-\,0.00287\,a_3}{0\,1885\,a_3 + 4}\,S_1 \quad \ldots(3)$$

The negative sign indicates that S_3 is in *compression*. The following table shows the effect of giving S_3 different areas.

a_3 sq. in.	S_3 Compression.	$\frac{S_3}{a_3}$	S_4 Tension.	S_2 Compression.	S_5 Tension	$\frac{S_5}{a_5}$
0	0	0	0.9328_1	0.3698_1		
5	0.00238_1	0.000468_1	0.9348_1	0.3678_1	$0.0016S_1$	$0.00016S_1$
10	0.00558_1	0.000558_1	0.9368_1	0.3658_1	$0.0078S_1$	$0.00078S_1$
100	0.01258_1	0.000138_1	0.9418_1	0.3608_1	$0.0176S_1$	$0.00176S_1$
1000	0.01498_1	0.000028_1	0.9438_1	0.3588_1	$0.0211S_1$	$0.00211S_1$

The above values show that the unit stresses in the diagonals and in S_5 are very small and that the stresses in S_4 and S_2 are but little different from those existing when the diagonals and S_5 are omitted. This is true not only for small values of a_3 but for absurdly large values.

If the pins at C and D are assumed to remain at a constant distance apart, for the upper diagonal, equation (2) becomes

$$S_3 = \frac{\frac{H\sin^2\theta}{a_4} - \frac{2\,V\cos^2\theta}{a^2}}{\frac{2\cos^3\theta}{a_2} + \frac{2}{a_3} + \frac{\sin^3\theta}{a_4}} \quad \ldots(4)$$

Substituting the numerical values used above

$$S_3 = \frac{0\,00631\,a_3}{0\,0295\,a_3 + 2}\,S_1 \quad \ldots(5)$$

the *positive* sign indicates that S_3 is in *tension*.

Assuming different values for a_3 the following results are obtained:

a_3 sq. in.	S_2 Tension.	$\frac{S_3}{a_3}$	S_4 Tension.	S_2 Compression.
0	0	0	0.9328_1	0.3698_1
5	$0.0146S_1$	$0.0029S_1$	0.9218_1	0.3798_1
10	$0.0275S_1$	$0.0028S_1$	0.9128_1	0.3888_1
100	$0.128\ S_1$	$0.0013S_1$	$0.842S_1$	0.4598_1
1000	$0.200\ S_1$	$0.0002S_1$	0.7918_1	0.5108_1

Here again the unit stresses in S_3 are quite small. The decrease in S_4 is but a trifle over 9.6 per cent., and the increase in S_2 a little under 20 per cent. even when a_3 = 100 sq. in.

The value of S_3 as given by equation (4) becomes zero when

$$\frac{H\sin^2\theta}{a_4} = \frac{2\,V\cos^2\theta}{a_2}$$

or for the numerical values used above θ = about 39°. For values of θ less than 39°, S_3 will be in *compression* and for greater values in *tension*.

In case there are two tiers of diagonals as in Fig. 1 S_3 becomes zero when

$$\frac{H\sin^2\theta}{a_4} = \frac{4\,V\cos^2\theta}{a_2} \quad [\text{See equation (2)}]$$

For the numerical values used above θ = about 47½°. For smaller values S_3 is in *compression* and for larger values in *tension*.

Many other special cases might be considered but the examples solved above are sufficient to show the method as well as the effect of the diagonals over the turntable.

Although the diagonals over the turntable change the stresses in the pieces S_4 and S_2 they may be arbitrarily proportioned since this change can be readily computed and provided for. The diagonals used in practice have so small effect upon the pieces S_4 and S_2 that it can be neglected without serious error. The stresses in the diagonals themselves need not be considered as the unit stresses will always be less than the usual allowable stresses.

The above discussion is limited to the case of *balanced loading* or the case where S_1 has its maximum stress. The method is readily applied to unbalanced loading whenever the forces applied at A and B are known.

Without going through the demonstration the value of S_3 for a single panel over the turntable with unbalanced loads at A and B is given by the following equation:

$$S_3 = \frac{\left(H_1 - H_2\right)\left(\frac{\cos^3\theta}{a_2} + \frac{1}{a_3}\right) + H_1\frac{\sin^3\theta}{a_4} - \frac{\sin\theta\cos^2\theta}{a_2} - \left(V_1 + V_2\right)}{\sin\theta\left(2\frac{\cos^3\theta}{a_2} + \frac{2}{a_3} + \frac{\sin^3\theta}{a_4}\right)} \quad \ldots(6)$$

This is under the assumption that both diagonals have the same area and that the verticals also have equal areas. The shape of the figure is symmetrical about the vertical axis, as shown in Fig. 2.

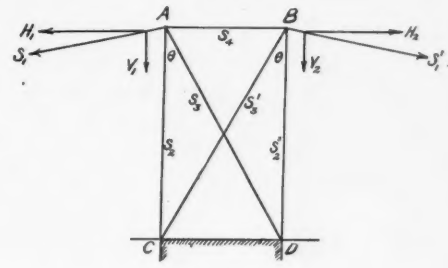


Fig. 2.

Introducing the numerical values used above and letting $H_1 = 2H_2$ and $V_1 = 2V_2$,

$$S_3 = \frac{0.0144\,a_3 + 0.0125}{0.0295\,a_3 + 2}\,S_1 \quad \ldots(7)$$

For various values of a_3 the results shown in the following table are obtained:

a_3 sq. in.	S_3 Tension.	S'_3 Comp.	S_2 Comp.	S'_2 Tension.	S_4 Tension.
0	0	0	0.3698_1	*0.3698_1	0.9328_1
3	0.0268_1	0.638_1	0.3878_1	0.2628_1	0.9138_1
5	0.0398_1	0.628_1	0.3968_1	0.2538_1	0.9048_1
10	0.0688_1	0.598_1	0.4178_1	0.2338_1	0.8848_1

Remarks.—When a_3 = 0 evidently $H_1 = H_2$ and $V_1 = V_2$ or the frame would collapse.

*Compression.

These results show that although one diagonal has a very *small tension*, the other has a very *large compression* which decreases very slowly as its area increases. For this diagonal to safely resist the compression its area would probably be larger than usually employed. Furthermore, this member is not commonly designed to take any but tensile stresses. If it is assumed to buckle under compression then equation (6) is replaced by

$$S_3 = \frac{H_1 - H_2}{\sin\theta} \quad \ldots(8)$$

Or, introducing the numerical values used above

$$S_3 = 0.659S_1 \text{ tension} \quad \ldots(9)$$

$S_2 = 0.835S_1$ compression $S'_2 = 0.1845S_1$ compression and $S_4 = 0.466S_1$ tension.

These stresses show that unbalanced loads at A and B cause quite large stresses in S_2 and S_3. Fortunately such a wide difference in these loads as assumed above does not ordinarily occur, so that the conclusions reached for balanced loads at A and B are not far from being correct for swing bridges with equal arms.

In view of the fact that the diagonals over the turntable may be in compression as well as in tension under certain conditions they should be designed to take either stress when proportioned arbitrarily.

The Rogers Locomotive Works.

We regret to learn that the Rogers Locomotive Works will be closed on Dec. 1, and the business wound up. The reasons assigned are that the equipment is now somewhat old and that considering the site of the works it would not be wise to spend the necessary money to bring the equipment up to date. The works are so situated that all fuel and material and all finished product must be trucked by teams, adding, as we have heard, perhaps $250 to the cost of each engine. All of this is no doubt true, but beyond that we judge from what we hear that the principal owners do not care to go on with the business and prefer to withdraw rather than spend any more work and energy. This is one of the oldest locomotive works in the country and its product is known all over the world, and, as a matter of sentiment, if for no other reason, we are sorry that it is to be closed down.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
PUBLISHED EVERY FRIDAY
At 32 Park Place, New York.

EDITORIAL ANNOUNCEMENTS

CONTRIBUTIONS—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

The returns of gross and net earnings of railroads in the United States for the six months ended June 30, 1900, made by the *Chronicle*, cover 177 roads and 149,999 miles. These roads aggregated 145,634 miles in the corresponding period of 1899, a gain this year of 3 per cent. The gross earnings this year were $611,253,241, against $537,522,942 last year, a gain of $73,780,299 or 13.72 per cent. The net earnings this year were $186,998,310, against $160,873,290 last year, an increase of $26,125,020, or 16.24 per cent. These increases follow very heavy gains in the years preceding. The gain in gross earnings on 172 roads in 1899 was $31,782,631, or 6.5 per cent.; in 1898 on 186 roads, $51,151,016, or 11.73 per cent. There was a slight falling off in 1897, but important gains in 1896 and 1895. In net earnings there has been no falling off since 1894. The increase last year was $11,242,792, or 7.78 per cent.; in 1898, $17,820,328, or 14.18 per cent. Among the different groups of railroads, the Southwestern, including 21 roads, shows the largest relative gain in net earnings, the percentage being 28.19. The 16 trunk lines show net earnings of over $11,000,000, or 25.36 per cent. Five Mexican roads show gains in net earnings of 20.39 per cent. The only group to show loss is the New England, including seven roads, where the loss is 2.17 per cent.

In our issue of Aug. 17, page 549, appeared an article by Mr. Koyl discussing the article on "Pure Water for Locomotives by Evaporation," which recently appeared in our editorial columns. Mr. Koyl asserts that the inference to be drawn from the editorial in question is, "that it is time we set about supplying locomotives with pure water by distillation," and from this inference he offers a dissenting opinion. We do not believe our article will sustain the inference drawn. It calls attention to the advantages of the distillation process, discusses its cost, estimates the probable maximum amount which roads can afford to pay for pure water, and concludes with the statement that "the proposition is not a hopeless one," that with low priced fuel, or with the efficiency of distilling apparatus increased beyond the present limit, "the argument becomes strong in favor of distillation." The article was the outgrowth of a belief that it would be economy for many roads to give greater attention than at present, to the purification of feed water, and that the process of distillation is of such promise that it should not be overlooked in any future consideration of the subject. Attention should be called to an apparent conflict of statement which is disclosed by a comparison of the original article, with its discussion by Mr. Koyl. The former credits the triple effect distilling apparatus with an efficiency which is much higher than values quoted by Mr. Koyl. The explanation is that the statement in one case refers to the possible output of condensed steam from all sources, and in the other case to the actual net output. The conditions on the distilling ship Iris are not the most favorable to high efficiency. The purification of sea water is a more exacting process than the purification of such water as that, with which railroads ordinarily have to deal. It is likely also, that better feeding arrangements can be had than are provided by the eleven steam pumps used on the Iris. It is even conceivable that for a plant near a large shop, all pumps might be driven from an external source of power at small expense. Under favorable conditions, it would not be necessary to consume from 30 to 50 per cent. of the water evaporated, in keeping the boilers and pumps of the plant itself in operation and the net output of the plant could be made to closely approach its theoretical maximum. There is nothing in what has been said concerning distillation, which is antagonistic to purification by chemical processes. Historically speaking, chemical treatment has been of slow development, but it now appears that the time is ripe for its rapid development. In our issue of August 24 we gave an abstract of an elaborate report made to the International Railroad Congress which well presents this phase of the general subject.

The Railroads of India.

We received two or three weeks ago the Administration Report on the Railroads of India for the working year ending March 31, 1900, the report itself bearing date of June 1. It will be seen that in the matter of promptness some government bureaus, as well as private enterprises, might take lessons from the Public Works Department of India.

The total length of railroad open for traffic March 31, 1900, was 23,763 miles, the net increase for the year having been 1,272 miles. There still remain 3,027 miles under construction or authorized. Of the railroad open for traffic 13,669½ miles are standard gage (5 ft. 6 in.), 9,496 miles are meter gage and 597½ miles are special gage.

The mean mileage worked during the calendar year ending Dec. 31 was 22,845¼ miles, being an increase of 1,370 miles over the previous year. The gross earnings for the year amounted to 294,318,276 rupees, the increase in gross having been 7 per cent. The net earnings were 154,124,192 rupees and the increase was 6½ per cent. The ratio of working expenses to gross earnings was 47.63 per cent. The standard gage roads worked amounted in miles to about 57 per cent. of the total operated in the year and these roads earned 73.75 per cent. of the total earnings. The meter gage roads earned 25.47 per cent. and the other small earnings were by special gage lines.

The earnings from freight were 192,374,862 rupees, or 65 per cent. of the total gross earnings. In the United States the earnings from freight in the same year were 70 per cent. of the total earnings. The passenger earnings we see in India amounted to a little more than one-third of the total earnings of the railroads, and yet the passenger movement there is immense in volume. In 1899 the passenger miles in India amounted to 6,201,157,238, the increase over the year before having been 6 per cent. This was a movement of 273,500 passenger miles per mile of road worked, but in the United States the passenger movement was only 77,821 passenger miles per mile of road worked. On the other hand, the freight movement is relatively much less than in the United States, it having been in India 273,000 ton miles per mile of road worked and in the United States 659,565. The ton miles in India were a trifle less in number than the passenger miles, but in the United States the ton miles were almost 8½ times as many as the passenger miles. Yet in India the freight earnings were 65 per cent. of all and in the United States 70 per cent. It will be observed that relatively to the business done the passenger earnings in India are very small as compared with those in the United States while the freight earnings are large. Of course, the exceedingly low passenger rates of India are too well-known to need comment. In the total passenger movement the first class was only 0.74 per cent., the second class 2.81 per cent. and the lower classes contributed 96.45 per cent. and this latter traffic was carried at 0.39 cent per passenger mile, or about one-fifth the average passenger rate in the United States.

It may be interesting to a few of our readers to know that while the percentage of expenses on gross earnings was 46.54 for the standard gage lines it was 50.21 for the meter gage and 66.87 for the special gages. We do not venture to deduce from this the conclusion that it necessarily costs more to work narrow gage than broad gage lines, although there are still some people who would claim that the converse of this proposition is absolutely true, namely, that it necessarily costs more to work broad gage lines than narrow gage lines relatively to the business done.

Almost nothing is said about the famine, but we suppose that another year's working will show more of famine effects than did the year under consideration. Brief mention is made of reduction of rates for food grains and fodder and of the establishment of relief works.

Among other matters mentioned in the review of principal events of the year is the establishment of a small traveling commission to inquire into local interests affecting railroad schemes. This commission is to sit and take evidence and will be open to all interested parties, and it is thought possible that such a commission may become part of the regular machinery of the railroad administration in the future.

A Measure of Engine Performance for Fast Trains.

Mr. T. A. Lawes, Superintendent of Motive Power and Machinery of the Chicago & Eastern Illinois, has compiled a table of high-speed trains including the schedule, the make-up of the trains and the principal dimensions of the locomotives used, which table is reprinted on another page. The comparison of different engines is made on a basis that we do not remember to have seen used before for such a purpose. The units are ton miles per hour per square foot of grate area and per square foot of heating surface, respectively. These quantities are obtained by multiplying the weight of the cars in tons by the average miles run per hour and dividing this product by the heating surface or grate area as the case may be. We observe that some engineers with whom we have talked, hastily assume that these results are a measure of the performance of the engines. We do not discover, however, that Mr. Lawes himself thinks so. On reflection it becomes clear that they only show roughly how hard the boilers and fire-boxes are worked and indicate nothing directly as to the economy or efficiency of working.

If train resistances were constant, the product of the weight of the train by the average speed would bear a fixed ratio to the horsepower; but the relation between the weight of the train and the tractive effort varies so widely under different conditions of speed and grade that this product is not even a close approximation to the power required for trains, run on different roads and at different speeds. The tendency of recent practice is to reduce rates of combustion, and the low results shown by Mr. Lawes probably indicate economy; yet the first impression from reading the table has been just the contrary in some instances.

The Chicago, Rock Island & Pacific eight-wheeler stands at one extreme, showing 745.3 ton-miles an hour for each square foot of grate and 9.18 for each square foot of heating surface, while the Lehigh Valley ten-wheeler is at the other extreme with corresponding figures of 166.4 and 4.83. These engines are of practically the same starting power and boiler capacity, the average speed is almost the same, and the difference in the showing is due partly to the fact that the Rock Island train weighs 404 instead of the Lehigh Valley's 227 tons, and partly to the fact that the grate of the Lehigh Valley engine is 63.9 sq. ft. against 24.5 sq. ft. for the Rock Island. In this instance probably the Lehigh Valley engine has considerably more reserve power, on the average is not worked so hard and is a more economical machine than the Rock Island engine; at least its proportions are more in accord with what seem to us advanced ideas of design.

The same thing is shown more forcibly in the case of the Chicago & Northwestern train, viz., that the low tabular results indicate lower rates of working the boiler and fire-box and, indirectly, better economy. In the table one of the recent Chicago & Northwestern eight-wheel engines is given having 2,504 sq. ft. of heating surface and 30.4 sq. ft. of grate. On the run between Chicago and Clinton, 711.1 ton-miles per hour are shown for each square foot of grate and 8.63 for each square foot of heating surface. As told in our description of the new "Northwestern" type engines, published August 3, these later engines were designed to give greater boiler capacity and an increase in grate area and they are plainly superior in many respects to former engines on that road. For instance, in hauling the same train shown in Mr. Lawes' table, the new "Northwestern" type engines use about 20 per cent. less coal than the engine of which dimensions are given in the table. If, however, the dimensions of the "Northwestern" type, with 3,016 sq. ft. of heating surface and 46.3 sq. ft. of grate, are substituted for those of the eight-wheel engine of the table, we get 466.9 ton-miles per hour and 7.1 instead of 711.1 and 8.63.

It seems quite safe to say that low results in ton-miles per hour per unit of grate or of heating surface merely indicate reserve power in the engine which is needed on account of grades or the importance of keeping

trains on time or possibly a desire to use lower rates of combustion. Assuming that the product of the speed and weight of train is a sufficiently accurate measure of the power of the engine for this purpose, it would seem that a more useful comparison could be made of the ton-miles per hour per pound of coal and per pound of water. This would tend to indicate the efficiency of the boilers and engines and bring out the advantages of wide grates and large heating surfaces for fast engines.

Annual Reports.

Boston & Albany.—The annual report for the fiscal year ending June 30 last, which is numbered the thirty-third, and is presumably the last to be issued by the company as an independent corporation, shows the highest gross revenue earned by the company in any year except 1893, when the gross income was $10,169,875, against the $9,956,138 now reported for 1900. The net earnings at $2,439,665 are $207,708 below last year's figures and also below the net revenue of every other year back to 1893. This tendency to increase operating expenses in proportion to or even in greater proportion than the enhancement in income, is, of course, in accordance with the well settled policy of not only the Boston & Albany, but of the other leading New England roads, to devote the gains in revenue to permanent improvements, so that each year's income is about all absorbed in expenses. Thus in the same fiscal year the Boston & Maine, with an increase in gross earnings of $2,258,000, improved its net only $399,000 and carried a surplus to the new account of $172,000. Taking the Boston & Albany's own accounts for ten years it will be found that while the extreme fluctuation in gross earnings was $1,000,000 net has not varied more than $450,000, the lowest figure of net income being made in 1893, when gross reached its highest.

Of the larger revenue in 1900, $631,103, the freight department accounts for $449,800 and passenger receipts for $227,138. The greater revenue was not due altogether to increased business; the Boston & Albany secured a rate of 8.2 mills against 7.8 mills in 1899, and on the total tonnage carried this improvement appears roughly to account for about $235,000, or a little over half of the total gain reported in freight receipts. The higher rates were also in part due to the less proportion of through business to the total. In fact, the east-bound through freight, which is nearly eight times as great as westbound, declined, so that the total through movement was 6 per cent. less than in the previous years, but still in excess of other years. As this question of the relative proportion of the company's through and local business has lately been much discussed and with considerable prejudice, it is opportune to give the following figures from the report, showing the totals and changes in the two classes of traffic for a series of years.

	—West-bound tonnage.—		—East-bound tonnage.—	
	Through.	Local.	Through.	Local.
1900.....	153,209	1,056,530	1,126,368	2,880,546
1899.....	118,388	890,869	1,243,283	2,594,608
1897.....	113,391	836,417	925,974	2,255,073
1895.....	137,156	846,737	837,835	2,172,612
1893.....	166,798	990,245	985,876	2,371,136

While as an independent line the Boston & Albany has not accomplished much in late years in increasing through business, its facilities for handling this traffic are excellent and it may be assumed that the proportion will grow. Curiously enough the fear that the New York Central would discriminate against Boston in the movement of export trade was at the bottom of most of the public opposition to the lease; while the New York Central probably had the splendid and ample terminals of the Boston & Albany in Boston greatly in mind when the lease was planned. The copy of the legislative act authorizing the lease which is bound together with a copy of the lease, in the present report, devotes two of its longest paragraphs to this point and provides among other things the expenditure of $250,000 annually by the New York Central upon the enlargement of the East Boston terminals. President Bliss states that a meeting of the Boston & Albany shareholders to vote upon the terms of the legislative act authorizing the lease will be held on Sept. 26, immediately following the annual meeting.

Cleveland, Cincinnati, Chicago & St. Louis.—During the fiscal year ending June 30, this company's totals of revenue, tonnage carried and surplus balance reached the highest figures since the consolidation in 1889. On 1891 miles of road, which is 53 miles more than was worked in 1899, the company earned, gross, $16,806,851, or $2,088,000 more than in 1899, of which increase freight traffic contributed over three-fourths or $1,641,000, against an increase of $408,000 in passenger revenue. Expenses absorbed $1,104,000 of this and the increase in net is $984,000 for the year. The balance after all charges was $2,191,049, which enabled the company to pay the regular 5 per cent. preferred dividend and to resume dividends at the same rate on the common stock after a suspension since 1893. After these deductions, and allowing for miscellaneous income, there was a credit balance of $934,143, and the company took advantage of this large surplus and its generally prosperous condition to pay off a balance of $821,000 owing on 2,000 freight cars bought on car trust notes, maturing monthly over a series of years.

The location of the lines of the Big Four Company in the middle Western manufacturing states, with lines reaching out to Peoria and St. Louis, securing a considerable grain business, permits an interesting test of the effect on railroad revenues of the increased rates which have been enforced during the better part of the twelve months covered by this report. President Ingalls points out that $782,100 of the gain in freight revenue and $233,200 of the gain in passenger receipts, or a total of $1,015,000 (nearly half the enhancement in gross receipts) was due to higher rates. The average ton-mile receipts were 5.8 mills, a gain of .42 mill over 1899, exactly the gain reported by the Erie. This increase, it may be noted, did not bring the figure back to the total of 1897, which was 6.14 mills.

Practically all the increased charges in expenses during the year are accounted for in transportation and equipment, the increases in these accounts being respectively $484,900 and $584,900. It does not appear, however, that the higher expenses are chiefly due to the larger tonnage carried during the year, but in good part to special circumstances. Two accidents, the burning of the freight house in Cincinnati and the loss of the Terre Haute Bridge and a train of cars cost the company over $125,000. Altogether, the increase in the loss and damage expenses, fire claims and the personal injuries account for an increase of $165,000 in the year's transportation expenses. The next largest increase is $124,000, equal to about 15 per cent., in the cost of locomotive fuel, but this is in part due to the increased price for coal.

The heavy expansion in equipment expenses, $585,000, is due, to a considerable extent, to the policy of the company in charging directly to expenses the cost of additional equipment as built. Thus, while the cost of freight locomotive repairs shows an increase of $225,000 or over 50 per cent. and the freight car repairs expenses show an increase of $332,000, these amounts have been swelled by including the cost of 16 locomotives, $258,000, and of 840 freight cars built at the company's own shops at a cost of $470,000. In addition, the company has expended nearly $100,000 in completing the equipment of its cars with automatic couplers, the report a year ago stating that 1,622 cars remained to be so equipped on June 30, 1899.

Traffic statistics showed only small increases in tonnage movement a year ago, but now reflect a large expansion in both freight and passenger business in 1900. Thus ton-miles increased 158,750,000 and passenger miles increased over 9,500,000. As important however as the actual gain in traffic movement was the increased economy with which the company was enabled to handle its business. While the proportion of empty car mileage to the total increased from 19.4 to 20.3 per cent., the number of loaded cars per train increased, tons per loaded cars were 14.27 against 13.3 tons, and the freight train load increased from 305 tons to 335 tons. In 1898, this unit was 278 tons, and in 1893 201 tons. Of this gain of 134 tons in seven years almost half has thus been secured in the last two years. Through this development of the train load, the company carried its increased tonnage with an actual decrease in the freight train mileage, the saving being 17,400 miles. The earnings per train mile were $1.95 in 1900, against $1.55 in 1899.

The event which is perhaps of largest significance in the past year's history of the company is not specifically referred to in the report. This is the company's purchase of a substantial interest in the stock capital of the Chesapeake & Ohio, this investment being made when the Pennsylvania made its heavy purchase in the shares of the same company. But while the latter company was mainly concerned, in making its investment, in conserving the present stability of rates in the soft coal carrying trade, the Big Four's interest was taken to retain the Chesapeake & Ohio as the eastern outlet for its important grain traffic. The only way in which this operation is noted in the report is an item in the balance sheet showing that the company has acquired $2,453,570 of the stock of the Chesapeake & Ohio. Just how much stock this item represents there is of course no means of telling. Chesapeake & Ohio stock during the past year has been quoted at an average price of about 30, and if it is assumed that the company made its purchases around that figure, it would appear that it owns approximately 81,800 shares out of a total outstanding stock of 605,278 shares, which would be a smaller proportion than has been generally assumed as the amount bought. The assumption, of course, may be far from the fact, and is merely the Wall street way of looking at the matter in default of any statement at all in the report covering the purchase.

The English Employees' Safety Law.

The "Prevention of Accidents Act" has finally passed the British Parliament, and received the assent of the Queen on July 30. The course of the discussion on this law during the past two years has been reported from time to time in the *Railroad Gazette*, but the final enactment of the bill makes it appropriate to again review the main facts. As the reader will remember, the question of a law of this nature to provide for ameliorating the risks incidental to railroad service was first proposed in 1898. The adoption of an automatic freight-car coupler was the principal feature of the original proposal, and Mr. Hopwood, Railway Secretary of the Board of Trade, came to this country to inquire into the experience of American railroads with vertical plane couplers. On his return the President of the Board of Trade presented in Parliament a bill giving the Board power, after five years, to prescribe automatic couplers, provided the railroads should not themselves introduce a satisfactory device before the expiration of that time. The bill at once met powerful opposition. All of the thousands of freight cars in England have link or chain couplings and side buffers; and besides the railroad interest, the private owners—that is to say, the proprietors of coal mines and other industries who furnish their own cars, and have thousands of them in service—unanimously opposed the bill. As a result of this opposition all reference to couplers has been entirely eliminated from the bill; and as finally passed it embraces the following twelve subjects:

1. Brake levers on both sides of wagons.
2. Labeling wagons.
3. Movement of wagons by propping and tow roping.
4. Steam or other power brakes on engines.
5. Lighting of stations or sidings where shunting operations are frequently carried on after dark.
6. Protection of point rods and signal wires, and position of ground levers working points.
7. Position of offices and cabins near working lines.
8. Marking of fouling points.
9. Construction and protection of gage glasses.
10. Arrangement of tool boxes and water gages on engines.
11. Working of trains without brake vans upon running lines beyond the limits of stations.
12. Protection to permanent way men when relaying or repairing permanent way.

It will be noted that all of the points named in this list bear directly on the personal safety of employees. The first two aim to make it unnecessary for guards to climb over or under cars. The third means, in Yankee phrase, poling and hauling by switch-rope. There are numerous opportunities, no doubt, on every road, where rules on some or all of these topics would be found useful—where the practice is not yet perfect and an improvement would be of benefit to the employees and to the railroad company—but we suspect that the promoters of the bill will not find any great satisfaction in their success. What they wanted was a coupler law—or at least some law for the benefit of employees which would be useful in stump speeches. But what they have got is a law which deals with matters so commonplace that to work up enthusiasm about it, in a speech or in a brotherhood meeting, will probably be out of the question. Moreover, such of these suggested reforms as are practicable will doubtless be carried out by the companies without governmental compulsion.

The law, which is Chapter 27 (63 and 64 Victoria), provides that the Board of Trade may make suitable rules concerning the subjects just mentioned. Where a danger is avoidable and a railroad, after notice, fails to reduce or remove the danger or risk the Board may take such action as it shall deem fit; may require the use of any plant or appliance which the Board believes will reduce danger, or the disuse of any which is shown to involve danger. Rules are prescribed for suitable notice and for hearing objectors. The Board, and also the Railway and Canal Commissioners, to whom appeal can be made, must take care to consider whether any proposed action will interfere with the trade of the country or with reasonable railroad operations. After a rule has been in operation three months objections to it may be made; after 18 months, if the Board declines to change a rule, appeal may be taken to the Commissioners. Non-compliance with a rule involves a fine of £50; if a continuing offense, £10 a day. The Commissioners having approved a rule may enforce it, as if it were an order of their own. Any company or person convicted may appeal to a court of quarter sessions. The Board of Trade may inspect railroads to see if action should be taken; and carriers, as well as proprietors of private sidings, must report personal casualties. The Board may hold inquiries and make experiments, in which the carriers must aid them, though without risk or expense to themselves.

The *Iron Age* has received a gold medal at the Paris Exhibition, this being the third award received by that journal at three consecutive international fairs held at Paris. This prize is well deserved. The special exhibit made was a remarkable collection of trade catalogues and like commercial literature from over 5,000 American manufacturers of iron, hardware and machinery. This collection was visited, examined and used by Europeans and by Americans from day to day and indeed was frequently consulted by men from all the buying nations. It often happened, in fact, that American manufacturers themselves had to make use of this collection to supplement the information which they had taken to the Exhibition. This was a novel enterprise and necessarily costly, but it was not only good business for the *Iron Age* but good patriotism, too.

NEW PUBLICATIONS.

Proceedings of the Master Mechanics' Association.—The report of the Proceedings of the thirty-third annual convention of the American Railway Master Mechanics' Association, held last June at Saratoga, is now received complete, in a volume of 400 pages, with index. This valuable publication can be had by addressing the Secretary, J. W. Taylor, Esq., The Rookery, Chicago, Ill. It gives the names of the committees for conducting the work of the Association for the next year, with the subjects which they have respectively to consider, there being twelve of these. It gives also the constitution and by-laws and list of members and then a full report of the Proceedings at Saratoga. Incidentally, there is included in this volume the alphabetical index and classified index of subjects of reports, papers and discussions covered by the Proceedings of the Association from 1869 to 1899, inclusive. We have already noted the issue of this

valuable pamphlet which was prepared by Mr. Frank Zeleny, of Aurora, Ill., under the direction of Mr. Delano and which is submitted as part of the report of the committee on the extent to which the recommendations of the Association have been put into practice. It will be obvious to anybody that such an index must be of great value to those who have occasion to look up special matters connected with the motive power and machinery of railroads.

Report of the Harbor Commissioners of Montreal for 1899.—In March of 1899 the President of the Harbor Commissioners of Montreal was able to report the conclusion of an agreement between that Commission, the city of Montreal and the Dominion of Canada, by which extensive improvements to the harbor facilities were assured. Plans for works of enlargement and improvement have been adopted, the system of wharves to be built has been settled and it is now a fact that "in all matters relating to its harbor and the river channel to deep water Montreal is to be considered as the national port of the Dominion." When the new works have been completed the harbor will be equipped to accommodate the increasing trade, inland and ocean, which now comes to the port, and is to be expected in the near future. A considerable amount of new work was carried on during the year 1899, being the completion of a new high level pier, the beginning of another pier and of a shore wharf, the enlargement of deepwater in the basin and the widening of the ship canal. All of these matters are treated in detail in that part of the report written by the Chief Engineer, Mr. John Kennedy. Furthermore, an agreement has been made with Mr. Conners, of Buffalo, N. Y., and certain gentlemen of Canada for building an elevator to take care of 3,000,000 bushels, and that work is now under way.

The Water Supply of the City of New York: An Inquiry Into Its Conditions, by The Merchants' Association of New York. Octavo, 628 pages, tables, maps, etc. New York: Merchants' Association, 236 Broadway; S. Cristy Mead, Assistant Secretary. Price, $3.

In our issue of the 24th appeared some extracts from this volume and a short editorial note thereon. Beyond this it is hardly necessary to say anything except to repeat that it is an important addition to engineering knowledge. It is the result of the serious work of a good many men and covers not only the engineering but legal and social conditions governing the better supply of New York City with water. The edition is limited to 4,000 copies and a small number of these will be sold by the Association at the price of $3. Those who desire to secure the volume may address Mr. Mead, the Assistant Secretary, as above.

Railroad Systems of Kansas City. By W. P. Trickett, Commissioner of the Kansas City Transportation Bureau.

This is a pamphlet of 25 pages, in which Mr. Trickett gives some notes on the early history of the railroads which center in that city. A picture is given showing how Kansas City looked in 1855, and another of a large two-story brick building in Independence (burned down a few years ago) which was the terminal of the first railroad ever built west of the Mississippi River. This was the Independence & Wayne City and was four miles long. The rails were of timber and the road was operated by mule power from 1849 to 1851. The cornerstone of the depot referred to was laid in 1848, and there was a great celebration, but the enterprise, which was the last effort of Independence to maintain its supremacy in the overland trade, proved a failure.

A Measure of Engine Performance for Fast Trains.

Mr. T. A. Lawes, Superintendent of Motive Power of the Chicago & Eastern Illinois, has compiled a novel table which was published in the August issue of the *American Engineer and Railroad Journal*. The table is a useful record of facts for those who study the various questions of train hauling, and it is interesting, as it shows certain relations between locomotives that are not often brought out; furthermore, it seems liable to some misinterpretation. For all these reasons we reproduce it. Some remarks on the table will be found in the editorial columns.

Six Months of Railroad Building in 1900.

This country built 2,110¾ miles of new railroad during the first six months of this year, according to the revised figures presented below. The preliminary estimate published in the *Railroad Gazette* of June 29 placed the total at 2,025½ miles. But corrections and additions since received increase the amount by 85 miles. The table shows that Texas leads with 173 miles. Iowa built 150 miles, Pennsylvania 127, Colorado 122, Minnesota 130, Georgia 117, and Mississippi 109 miles. The Chicago & Northwestern has built 187 miles, the largest mileage built by any single company. The Chicago, Burlington & Quincy built 101 miles, the Southern Pacific 96, the Seaboard Air Line 95, the Gulf & Ship Island 72, the Atchison, Topeka & Santa Fe 66, the Chicago, Rock Island & Pacific 57, and the Northern Pacific 52 miles. Four Mexican roads have also made large increases in their mileage: the Merida-Valladolid 111 miles, the Mexican International 82, the Mexican Southern 58, and the Mexican Central 50 miles. The accompanying table gives a summary of the mileage by states and territories. For comparison there is added the mileage built during the corresponding six months of last year and also during the entire year 1899. Canada has built 186 miles and Mexico 464. Usually the new Mexican mileage falls much below that of Canada. But this year there is a notable increase of railroad building by our neighbor on the south. Below are given particulars in detail by states and territories of railroads building and sections completed.

New Railroad Building in 1899 and 1900.

States and Territories.	Six months to June 30, 1900. Miles.	1899. Miles.	Year. 1899. Miles.
Alabama	46.02	14.25	160.48
Alaska	....	....	1.4
Arizona	41.97	23.7	49.
Arkansas	62.	83.	281.7
California	121.6	45.9	174.76
Colorado	8.75	3.	83.42
Connecticut	....	6.5	19.65
Delaware	....	....	....
District of Columbia	....	....	....
Florida	57.	60.5	138.7
Georgia	117.07	48.6	136.71
Idaho	23.8	40.	160.86
Illinois	44.9	....	96.7
Indiana	34.2	7.	77.3
Indian Territory	45.	43.	77.
Iowa	149.89	14.51	563.97
Kansas	....	4.	12.5
Kentucky	7.	....	17.
Louisiana	16.7	62.	137.22
Maine	....	....	41.65
Maryland	7.	19.	41.
Massachusetts	....	....	4.2
Michigan	37.67	4.	168.86
Minnesota	130.18	13.	374.35
Mississippi	109.5	85.	141.68
Missouri	28.5	41.2	100.36
Montana	30.5	2.	32.7
Nebraska	54.	1.	59.6
Nevada	....	....	....
New Hampshire	....	....	....
New Jersey	3.36	....	9.5
New Mexico	....	23.07	125.39
New York	9.4	6.5	40.83
North Carolina	27.	30.14	103.4
North Dakota	26.	....	41.16
Ohio	23.24	61.	77.82
Oklahoma	90.5	76.	157.21
Oregon	42.5	25.	26.6
Pennsylvania	126.7	105.92	212.23
Rhode Island	....	....	....
South Carolina	85.86	50.2	123.72
South Dakota	28.	....	....
Tennessee	68.5	7.	54.46
Texas	173.5	25.	91.59
Utah	.25	52.96	93.95
Vermont	25.2	2.	16.9
Virginia	36.	1.75	63.75
Washington	43.1	13.	77.57
West Virginia	55.75	10.5	44.1
Wisconsin	17.	14.	47.27
Wyoming	55.6	....	9.27
United States	2,110.71	1,181.45	4,569.49
Canada	186.		656.29
Mexico	464.29		267.05

UNITED STATES.

Alabama.

Birmingham Belt.—In the city of Birmingham	2
Carrollton Short Line.—Reform to Kilpatricks	3
Chattahooche & Gulf.—Columbia to Dothan	21
Cooper & Crosby, of Brantly.—From Brantly to end of track	3
Louisville & Nashville.—Spur to Gadsden furnaces, 3.6 miles; Brookwood to Searies, 3.17 miles; total	6.77
Pine Hill & Sweet Water.—Pine Hill toward Sweet Water	1
Southern.—Tennessee Coal, Iron & R. R. spur at Russellville	1
Tombigbee & Northern.—Turners to Higdons	7
Zenida Coal Co.—Zenida to coal lands	1.25
Total	46.02

Arizona.

Arizona & Southeastern.—Extension	4
Arizona & Utah.—Chloride to Tillman	3.5
Ray Copper Mining Co.'s line from its mines near Riverside	5.72
Santa Fé & Grand Canyon.—End of track, 25 miles from Williams to Coconino	28.75
Total	41.97

Arkansas.

Deckersville, Osceola & Northern.—Osceola to Luxora	5
Little Rock & Hot Springs Western.—Completion of line from Little Rock to Hot Springs	27.
Mississippi River & Northwestern.—Extension	14
Saline River.—Draughton toward Warren	16
Total	62

California.

Anderson & Bella Vista.—Anderson to Bella Vista	13
Brooking Lumber & Box Co.'s line in San Bernardino Co.	0.5
McCloud River.—McCloud to Ash Creek Mill	12
Nevada-California-Oregon.—End of track, 35 miles from Amadee to Termo	15
San Francisco & San Joaquin Valley.—End of track, 49 miles from Stockton to Point Richmond	21.4
Sierra of California.—Jamestown toward Angel's Camp	5
Southern Pacific.—Jalama to Socate, 15.2 miles; Ellwood to Gato Canyon, 5.9 miles; Somis to Stathearn, 11.8 miles; total	32.9
West Side Flume & Lumber Co.'s line from Carters to Willow Meadows	21.8
Total	121.6

Colorado.

Colorado & Southern.—Forbes Junction to Southern Coal Co.'s mines	1.75
Crystal River.—Redstone toward Coal Basin	5
Denver & Rio Grande.—Rio Grande, Pagosa Springs & Northern extension from point 13 miles from Gato to end of track	2
Total	8.75

Florida.

Ellaville, Westlake & Jennings.—Bellville to Mallory Place	7
Florida & Georgia.—Wellboro to White Springs	16
Fort White & Southern.—Santafé Junction to end of track	6.5
Jacksonville & Southwestern.—Worthington Springs to Newberry	24
Valdosta Southern.—Sanderson toward Madison	3.5
Total	57

Georgia.

Georgia Northern.—End of track, 5 miles, from Doerun to Albany	18
Nashville & Sparks.—Sparks toward Nashville	9
Ocilla & Worth.—Extension of line	4
Offerman & Western.—Offerman to Nicholls	35.5
Seaboard Air Line.—Georgia & Alabama extension from end of line, 8 miles, from Savannah to Meldrim	9.57
Sparks, Moultrie & Gulf.—Kalamazoo to Tipton	23
Tipton, Thomasville & Gulf.—Moultrie to Big Creek, 17 miles; Aberdeen to Moultrie, 1 mile; total	18
Total	117.07

Idaho.

Northern Pacific.—Clearwater Short Line, from end of track, 35.6 miles from Potlatch to Kooskia	23.8

Illinois.

Chicago & Eastern Illinois.—Completion of line from Marion to Thebes	16.5
Indiana, Illinois & Iowa.—End of track, 21.4 miles west of Streator to Seatonville	17.1
Peoria & Pekin Terminal.—Peoria to Pekin	11.3
Total	44.9

Indiana.

Chicago & Wabash Valley.—Lewiston to end of track, 1 mile beyond Pleasant Grove	4
Southern Indiana.—Victoria to Terre Haute	30.2
Total	34.2

Indian Territory.

Little River Valley.—End of track, 3 miles from Arkansas line toward Lockburg	5
St. Louis & San Francisco.—Sapulpa south to end of track	40
Total	45

Iowa.

Chicago & Northwestern.—Iowa, Minnesota & Northwestern extension from Mason City to Belle Plaine	106.33
Chicago, Rock Island & Pacific.—End of track, 4 miles from Gowrie	10.86
Minneapolis & St. Louis.—Completion of line to Storm Lake	32.7
Total	149.89

DATA OF CERTAIN FAST TRAINS.

Name of R. R.	From-To	Distance in miles	No. of cars in train	Weight of cars in tons	No. station stops	Miles run to one stop	Schedule running time—hours, min.	Average speed in miles per hour	Style of engine	Size of cylinder, in.	Diameter driving wheel, in.	Grate area, sq. ft.	Total sq. ft. heating surface	Boiler pressure in lbs.	Tractive power at 85% of boiler pressure, lbs.	Ton miles per hour per sq. ft. of grate area	Ton miles per hour per sq. ft. of heating surface
N. Y. C. & H. R.	New York-Albany	143	4	190	none	....	2 40	53.7	8 Wh.	19×24	78	31.2	1,974.0	180	17,000	327.0	5.1
C. B. & Q.	Chicago-Burlington	206	4	200	2	103	3 52	53.3	Columbia	18×26	84	31.8	1,509 5	200	17,045	335.2	6.6
B. & O.	Baltimore-Washington	40	7	240	none	....	45	53.3	10 Wh.	20×26	78	34.3	2,155.1	190	23,740	372.9	5.9
Wabash	Tilton-Granite City	176.6	7	302	8	22	3 36	49.0	Atlantic	19×26	73	29.8	2,423.2	200	21,860	496.2	6.1
Lehigh Valley	Buffalo-Jersey City	446.6	7	226.75	11	40.6	9 31	46.9	10 Wh.	19×26	70	33.9	2,200.0	180	20,510	166.4	4.83
C. & N. W.	Clinton-Chicago	138	9	470	6	23	3	46.0	8 Wh.	9½×26	68	30.4	2,504.2	190	23,495	711.1	8.63
C. R. I. & P.	Englewood-Rock Island	174	10	404	14	12.4	3 51	45.2	8 Wh.	19½×26	78	24.5	1,988.3	190	20,482	745.3	9.18
C. C. C. & St. L.	St. Louis-Indianapolis	273	8	340	9	30.3	6 5	44.8	8 Wh.	20×26	78	31.0	2,162.0	200	22,665	491.3	7.04
C. & E. I.	Dolton Jct.-Danville Jct.	106.5	5	190	8	13.3	2 25	44.1	8 Wh.	18×24	66	18.3	1,393 4	170	17,020	514.0	6.91
									8 Wh.	18×24	66	24.3	1,397.4	180	18,020	344.8	5.9
									Mogul	18×24	63	26.1	1,482.3	180	18,880	319.8	5.65
L. S. & M. S.	Chicago-Buffalo	535	8	335	14	38.2	12 53	41.8	10 Wh.	18×24	68	27.35	1,366.0	190	18,465	511.9	7.5
Atlantic Coast Line	Richmond-Charleston	396	5	225	2	198	9 46	40.5	Atlantic	19×24	72	26.1	2,047.2	180	18,410	345.3	4.8
Grand Trunk	Port Huron-Blue Island Jct.	315.5	9	300	15	20	7 55	40.4	10 Wh.	20×26	72	33.3	2,601.0	200	24,550	363.9	6.05
Great Northern	Minneapolis-Barnesville	210	11	not given	8	26.2	5 20	39 4	10 Wh.	19×26	73	24.6	1,797.0	180	19,670	....	....
M. C.	Detroit-Kensington	271	8	262	9	30.1	7 10	37.7	10 Wh.	19×24	62	28.5	1,703.8	160	19,000	346.5	5.79
Northern Pacific.	Northtown Jct.-Fargo	229.2	8	330	6	38.2	6 15	37.2	10 Wh.	20×26	69	30.8	2,485.0	200	25,620	398.5	4.9
Ill. Central	Fulton-Memphis	121	10	395	5	24.2	3 30	34.5	10 Wh.	19½×26	69	28.0	2,031.7	200	24,416	486.6	6.7

Kentucky.

Kentucky Western.—End of track, 10 miles from Dixon, toward Blackford	3
Licking Valley.—Fugate to end of track	3.5
Peach Orchard Coal Co.'s line to its mines	0.5
Total	7

Louisiana.

Leesville, East & West.—Leesville to end of track	8
Shreveport & Red River Valley.—Luella to St. Maurice	2.1
Texas & Pacific.—False River to New Roads	6.6
Total	16.7

Maryland.

Bear Creek Lumber Co.'s extension from end of track, 10 miles from Friendsville	5
Meadow Mountain Lumber Co.'s spur into timber	2
Total	7

Michigan.

Boyne City & Southeastern.—Extension	5
Detroit & Mackinac.—Onaway to Tower, 4 miles; Black River northwest, 10 miles; total	14
Grand Rapids & Indiana.—Through Lake City	3.17
Isle Royal Copper Co.'s line from mines to ore docks on Portage Lake	.5
Manistee & Northeastern.—Copemish to Betsy River, 5 miles; Platte River branch, 2 miles; total	7
Mineral Range.—Newton toward Mass City	8
Total	37.67

Minnesota.

Burlington, Cedar Rapids & Northern.—Wilmont to Hardwick	20.5
Canadian Northern.—Manitoba & Southeastern extension from Manitoba line to War Road	15
Chicago & Northwestern.—Blue Earth to Fox Lake, 29 miles; Tyler to South Dakota line, near Astoria, S. D., 30.9; west of Jeffers to Currie, 19.95 miles; total	79.85
Duluth & Iron Range.—Norman mine to Fayal mine	3.25
Duluth, Messabe & Northern.—Third street, Duluth, to ore dock No. 3, 0.52 mile; Adams Branch Ereleth to Spruce mine, 0.55 mile; Ereleth to Adams mine shaft, No. 4, 0.29 mile; total	1.36
Great Northern.—Spur to Commodore mine, 2 miles; extension from point 1.35 miles west of Minnetonka Beach to point 1.15 mile east of Coney Island, 8.22 miles; total	10.22
Total	130.18

Mississippi.

Gulf & Ship Island.—Saratoga to Jackson, 51 miles; completion to Columbia, 21 miles; total	72
Illinois Central.—Leland to Bogue Phalia, 17 miles; Isola to Belsola, 9 miles; Black Bayou to Philippi, 3.5 miles; total	29.5
Kingston Lumber Co.'s line from Laurel	8
Total	109.5

Missouri.

Arkansas & Oklahoma.—Southwest City to end of track	2
Cairo, Memphis & Southern.—Caruthersville to Covington, 12 miles; Bragadocio to Kauffman, 5 miles; total	17
St. Louis, Morehouse & Southern.—Morehouse south	8
St. Louis Terminal.—Extension in St. Louis	1.5
Total	28.5

Montana.

Montana.—Martinsville to Merino	24
Northern Pacific.—Grantsdale to Charlos	6.5
Total	30.5

Nebraska.

Chicago, Burlington & Quincy.—Northport to Wyoming line	54

New Jersey.

Central of New Jersey.—Extension to Chimney Rock	1.86
Newton, Lawrenceville & Princeton.—Stony Brook to Princeton	1.5
Total	3.36

New York.

Massena Terminal.—Massena Springs to powerhouse of St. Lawrence Power Co.	2
New York Central & Hudson River.—Completion of line to Rotterdam Junction	.4
Ulster & Delaware.—Davenport Center to Davenport	7
Total	9.4

North Carolina.

Aberdeen & Rock Fish.—Dundarrah (6 miles from Raeford) to Townson	6.5
East Carolina.—Daviston to end of line	1
Ohio River & Charleston.—Tennessee line to end of track	10
Transylvania.—Brevard to Taxaway	9.5
Total	27

North Dakota.

Bismarck, Washburn & Great Falls.—Bismarck to Milton	26

Ohio.

Cincinnati Connecting Belt.—Idlewild to Bond Hill	2.24
Hocking Valley.—Greendale to Lost Run	3
Lake Terminal.—Extension of terminal lines at Lorain	10
Newburgh & South Shore.—Extension	3
Ohio Valley & Junction.—Meichsville to Midvale	5
Total	23.24

Oklahoma Territory.

Atchison, Topeka & Santa Fé.—Eastern Oklahoma extension from Perkins to Pawnee	44.4
Chicago, Rock Island & Pacific.—Kingfish to Cashion, 16.1 miles; Mountain View West, 30 miles; total	46.1
Total	90.5

Oregon.

Columbia Ry. & Navigation.—Portage Road, near The Dalles	11
Columbia Southern.—Grass Valley to Shaniko	31.5
Total	42.5

Pennsylvania.

Bangor & Portland.—Nazareth & Lehigh extension from Nazareth to Christian Springs	1
Brookville.—Lyle Summit toward Dyson	2
Buffalo & Susquehanna.—Cowley Junction to Salt Run	18
Elk & Highland.—End of track, 4.05 miles from Coon Run to Middletown, 2 miles; branch to Rodgers Mills, 4 miles; total	6
Ketner, St. Mary's & Shawmut.—Ketner Junction to Beardsleys	9
Kushequa.—Completion of line from Kushequa to Smethport	9
L. D. Washburn's line at McKean from mills to timber tract	2
Leetonia.—Gaines Junction toward Four Mile Run	2
Lewisburg & Buffalo Valley.—Completion to Loganton	10
Masontown & New Salem.—Masontown to New Salem	8
Monongahela & Washington.—End of track, 5 miles from Monongahela to Ellsworth	7
North Bend & Kettle Creek.—Black Forest to Deemer Line, 1 mile; Starr to Sumit, 1 mile; total	2
Ohio River Junction.—Callery Junction to end of track	4
Pennsylvania.—Girard Point, Philadelphia, to League island, 1.49 miles; Madera Branch Junction to Standard mine No. 4, 1.13 miles; Paint Creek Branch to Eureka mine No. 37, 1.52 miles; Southwest Pennsylvania Junction to Ruffsdale coal mine, 1.24 miles; Cambria & Clearfield R. R. to Glenwood coal mine No. 10, 1.55 miles; Philadelphia & Reading Junction to Millbourne mills, 2.06 miles; Flowing Springs to quarries, 4.5 miles; total	13.49
Pittsburgh, Allegheny & McKees Rocks.—Completion of line	9.5
Pittsburgh, Shawmut & Northern.—Smethport to Coryville	6.5
Pittsburgh, Westmoreland & Somerset.—Blue Stone toward Somerset	1
Quakerton & Eastern.—End of track 1.4 miles beyond Durham	.5
State Run.—Extension	2
Smithfield & Masontown.—Smithfield to Leckrone	7.95
Susquehanna Coal Co.'s line from Nanticoke to Stearns	4.5
U. S. Government road in the Navy Yard, Philadelphia	1.26
Total	126.70

South Carolina.

Conway & Seashore.—Pine Island to end of track	2
Lockhart.—Completion of line from Lockhart Junction to Lockhart	5.86
Northwestern R. R. of South Carolina.—Sumter to Border	15
Seaboard Air Line.—End of track 5 miles beyond Middendorff to Columbia	63
Total	85.86

South Dakota.

Chicago & Northwestern.—Minnesota State line to Astoria	1
Chicago, Burlington & Quincy.—Hill City to Keystone	6
Chicago, Milwaukee & St. Paul.—From Napa to Tyndall	21
Total	28

Tennessee.

Cairo, Memphis & Southern.—Slough Landing to Stark, 22 miles; Yeggeville to Rogers Dam, 9 miles; total	31
Mt. Pleasant Southern.—Ridley to end of track, 1½ miles beyond Scotts Mills	6.5
Ohio River & Charleston.—Unaka Springs to North Carolina line	4
Tennessee & Alabama Mineral.—Lawrenceburg to Smith ore mines	8
Tennessee Central.—End of track, 11 miles from Kingston toward Monterey	19
Total	68.5

Texas.

Calvert, Waco & Brazos Valley.—Lewis switch toward Bryan	5
Cane Belt.—Bismarck to Wharton	8
Huntsville & Southeastern.—Extension	3
Lufkin Land & Lumber Co.'s line from Lufkin southwest	3.5
Missouri, Kansas & Texas.—Sherman, Shreveport & Southern extension from Jefferson to the Louisiana line	29.5
Southern Pacific.—Rockland to end of track 2 miles beyond New Homer, 25 miles; Cedar to Athens, 24 miles, Wharton southeast, 14 miles; total	63
Texas & Northeastern.—Village Mills to Morton	15
Texas Central.—End of track, 3 miles beyond Lueders, to Stamford	13
Texas State.—Extension west	3
Trinity Valley.—Dodge to Oakhurst	6.5
Union Central.—Wortham to end of track	6
Warren & Corsicana Pacific.—Warren to Campwood	18
Total	173.5

Utah.

Salt Lake & Ogden.—Extension to Farmington	0.25

Vermont.

Rutland-Canadian.—On line to Alburgh	25.2

Virginia.

Norfolk & Western.—On line from Bath Creek to Crab Creek	3
Seaboard Air Line.—Richmond, Petersburg & Carolina line from Petersburg to Richmond	22.7
Southern.—Round Hill to Blue Mont	4.3
Virginia Northern.—Shenandoah to Massanutton	6
Total	36

Washington.

Bellingham Bay & Eastern.—New Whatcom to Lake Whatcom, 4 miles; Park to timber, 2 miles; total	6
East Side (Olympia, Wash.)	.4
Northern Pacific.—Palmer to Auburn	21.7
Oregon R. R. & Navigation.—Dayton to Turners	13
Tacoma Eastern.—On line from Lake Park	2
Total	43.1

West Virginia.

Central of West Virginia.—Four miles beyond Morgantown to Preston County line	8
Chesapeake & Ohio.—End of track, 4 miles from Whitcomb to Falling Springs, 21 miles; Prince to end of track, 4 miles; total	25
Hinton, New River & Western.—On line from Hinton	1
Leatherwood Lumber Co.'s line up Leatherwood Creek	2
Kanawha & Pocahohtas.—Dego up Paint Creek Valley	5
Pickens & Hackers Valley.—Switchback siding to Lower Fall Run	2.75
Porters Creek & Gauley.—Extension	3
West Virginia & Pittsburgh.—Camden-on-Gauley to Cherry River	9
Total	55.75

Wisconsin.

Chippewa River & Menominee.—Extension	5
Rice Lake, Dallas & Menominee.—Barron to Dallas	12
Total	17

Wyoming.

Chicago, Burlington & Quincy.—Nebraska line to Guernsey	41
Colorado & Wyoming.—Hartville Junction to Sunrise	14.6
Total	55.6

Canada.

Algoma Central.—Sault Ste. Marie to Aweres	15
Canada Atlantic.—Glen Robertson to Hawkesbury	21
Canadian Northern.—Lake Manitoba Ry. & Canal extension from near Bell River (65 miles from Cowan), 14 miles; Gilbert Plains Branch from point 10 miles from Dauphin, 6 miles; total	20
Canadian Pacific.—McGregor toward Varcoe, 15 miles; Molson toward Lac du Bonnett, 10 miles; Glenwood to Mother Lode mine, 5 miles; total	30
Central Ontario.—End of track, 2 miles from Coe Hill, to Bancroft	19
Great Northern (Canada).—End of track, 14 miles from Montealm, to Shawenegan	39
Midland of Nova Scotia.—End of track, 43 miles from Windsor, to Truro	15
White Pass & Yukon.—End of track, 17 miles from Caribou, to White Horse	27
Total	186

Mexico.

Chihuahua & Pacific.—End of track, 7 miles from San Antonio, to Guerrero	47
Chihuahua Mineral.—Santa Eulalia to Hacienda Robinson	11.2
Coahuila & Pacific.—Saltillo to end of track	10
Merida-Valladoid.—Merida to Tunkas, 88.5 miles; Conkal to Progreso, 25 miles; total	111.5
Mexican Central.—Michoacan & Pacific extension from Chavinda toward Tinguindin, 9 miles; Ameca to San Marcos, 16.7 miles; Guadalajara toward Colima, 24 miles; total	49.7
Mexican Coal & Coke Co.'s line from Barroteran to Conquista	10
Mexican International.—Durango to Chinacates	81.83
Mexican Southern.—Tlacotepec & Huajuapamde Leon extension from point 19 miles from Las Pilas to end of track, 12 miles; Tehuacan to Esperanza, 31 miles; Oaxaca toward Ejutla, 15.5 miles; total	58.5
Mexican Union.—Rincon de Romos to Cobre	10.56
New line from Selva on the Sonora to the Copete mine	10
Parral & Durango.—Parral to Presena, 7 miles; Rincon to Station 300, 3 miles; total	10
Vera Cruz & Pacific.—End of track, 12 miles from Motzorongo, to Tierra Blanca	19
Xico.—Mexico City to Ecatzingo	35
Total	464.29

Painting of Pennsylvania Railroad Locomotives.

BY C. H. CARUTHERS.

Not railroad men alone, but the general traveling public also, have noticed favorably the pleasing appearance given to all locomotives and tenders of the Pennsylvania Railroad by the designs followed in painting. All parts, excepting bell, whistle, links, guides and mountings, are painted black (including, since 1895, the boiler jacket), and on wheels, cab and tender are stripes of gold leaf and white in the case of the passenger equipment, and of lemon yellow and white on all others. These stripes are uniform in size and design, the larger ones, gold leaf or lemon yellow, being about ½ in. wide; and the smaller, white, ⅛ in. wide. The number of the engine is placed on the cab panel, and the letters P. R. R. on the sides of the tank of the tender; and the number is also placed on the rear end of the tank. These letters and figures are of uniform type on all classes of engines; but, as with the stripes, gold leaf is used on passenger engines and lemon yellow on all others. The striping divides the corners, ends and sides of the tanks into panels. The vertical and horizontal lines of these panels do not meet at right angles, but by an arc described from a center at a distance of about 4 in. from these vertical and horizontal lines. The small white lines follow the contour of the larger lines at a distance from them of about an inch. The same arrangement of stripes is observed in the cab panels and on the headlights.

Very little change has been made in the painting of these engines since 1868, when black was adopted as the standard color. Until 1874 the figures and letters were shaded in two colors, and the numbers were on the sand-boxes. In 1881 the class K engines were built, and as this and succeeding classes had the sand boxes placed under the running board, the numbers were placed in the panels of the cabs, and this location was soon after adopted for all types of engines regardless of position of sand box.

In 1892 the striping of dome-casings and sand boxes was discontinued, excepting on engines having those of the old type with cornices and molded bases. On these the stripes before named are supplemented by small stripes of Tuscan red and orange, and all completely encircle the parts. During 1887 freight engines were painted without stripes of any sort, and the initials, P. R. R., and the number were painted on the front part of the flared guard at top of tender, but in 1888 the present standard was resumed.

Uniformity of design in painting all engines was first adopted by the company about the latter part of 1866, when black for the wheels and a warm tint of burnt umber for the other parts of engine and tender was adopted. The lettering and striping was of the same design as described in use up to 1881, except that vermilion instead of white was used for the small stripes.

From 1862 to 1866 dark colors were generally used by the company, but each shop followed its own designs, and a disposition to cling to the many-colored designs of previous days was shown in wheel casings of ultramarine blue, number plates of vermilion, sand boxes of green, and parti-colored passenger engine tenders with vermilion wheels, even after the engine wheels were painted in somber black, as this color for all engine wheels was adopted early in 1864. Even after these brilliancies had vanished, the cabs, headlights and tenders of passenger engines had their dark grounds covered with richly tinted arabesques, until the order for uniformity in 1866. This order does not seem to have been given to builders outside of the company's shops until after the adoption of black in 1868, as before that date M. W. Baldwin & Co. furnished many engines of colors and ornamentation varying widely from the company's patterns. A number of engines, both for freight and passenger service, came from Baldwin's with wheels

of vermilion and much arabesque work in 1866 and the early part of 1867. From 1854 to 1862 the painter was in his glory on these engines, and adorned them in rainbow hues, intricate arabesques and landscapes, even placing his arabesques in the panels of the beautiful walnut wood of the cabs of most of the passenger engines, as these walnut cabs were at that time highly polished and varnished. Driving wheels and truck wheels were vermilion in those days; sand-boxes of blue, brown or green, with vermilion panel in center bearing the number, after these replaced the names; cabs with framings of green or Indian red, and panels many colored; tenders of all tints, often with panels of vermilion or emerald green, bearing name, and, later, number.

From 1849 to 1854 the painting appears to have been of a much quieter type. The colors used were mostly green, and an occasional Norris engine blossomed out in chocolate. The first 35 engines had no lettering of any sort on the tenders, but the sides of the cisterns were divided by stripes into two panels. At least one engine, the Dauphin, afterward No. 34, was seen by the writer in 1855, with the tender yet painted in this way.

One point has been overlooked. Late in 1863, and continuing until early in 1867, the sides of all freight engine tenders were marked Penna. R. R., but ever since only the initials, P. R. R., have been used.

TECHNICAL.

Manufacturing and Business.

The Bethlehem Steel Co. has given up its St. Louis office and the territory heretofore covered by it will be directed from the Chicago office of the company.

The Ingersoll-Sergeant Drill Company of New York, has received the Grand Prize at the Paris Exposition for their mining exhibit, this being the highest award given.

The Chicago Pneumatic Tool Co., Chicago, is informed by cable that its pneumatic tools were awarded a gold medal at the Paris Exhibition; also, that Mr. Boyer receives a gold medal as the inventor.

At the Paris Exhibition the J. G. Brill Company has received the gold medal for the convertible open and closed car, also the grand prize for the complete system of electric trucks made by that company.

The rapid growth of the export business of the B. F. Sturtevant Co. of Boston, Mass., is illustrated by recent foreign orders for forges which aggregate 200 for Japan, 75 for Russia, 40 for Germany, 32 for Canada and 24 for Sweden in addition to large numbers distributed through its London and Continental stores. Domestic demands have likewise increased in the same line during the past few months. The town of Boulder, in the new gold fields of West Australia, was recently equipped by the B. F. Sturtevant Co. with generating sets for lighting and power purposes and electric motors for operating hoists, etc., in the mines.

Iron and Steel.

The Cambria Steel Co., at Dunbar, Pa., has shut down all its works for an indefinite period.

The new Buffalo Steel Company's plant of Tonawanda, N. Y., was opened for work, Aug. 18.

The Hilton Bridge Construction Co., of Albany, N. Y., is reported absorbed into the American Bridge Co., to take effect Sept. 1.

The Russian Government has given a contract to the Carnegie Co. for 1,000 tons of Krupp armor plate at $560 a ton. The armor is to be delivered at St. Petersburg within 14 months.

The Smith Machine Screw Co. was incorporated in Delaware, Aug. 22, with a capital stock of $40,000. The principal office is East Orange, N. J. Joseph B. Moran, Daniel H. Gugrue and John J. O'Connor are incorporators.

The Princess Iron Co. was incorporated in Delaware, Aug. 22, with a capital stock of $600,000, to manufacture iron and steel. The principal office is at Camden, N. J. The incorporators are: Frank R. Hansell, Geo. H. B. Martin and Wm. F. Eidell.

Pueblo Bridge Co.

The business of the Pueblo Bridge Co. has been sold to the Bullen Bridge Co. at Pueblo, who will complete all contracts and assume all liabilities. The Bullen Bridge Co. has been incorporated with the following officers: Geo. H. Hobson, President and Treasurer; C. A. Bullen, Vice-President; Fred H. Bullen, Secretary; Geo. C. Bullen, Chief Engineer; H. L. Hollister, Assistant Engineer.

A New Inclosed Motor.

An improved inclosed electric motor, adapted for driving light machine tools or blowers, has been made by the B. F. Sturtevant Co. of Boston. Encased fans of centrifugal type, or other work when conditions favor, may be connected directly to the motor. The machine is designed to run continuously for ten hours, with a maximum temperature rise not to exceed 60 degrees F. The armature shaft is supported by yokes extending out from the field ring. The end casings are removable. By removing only the caps in the center of these casings the bearings and brushes are accessible. The brushes are hard carbon, and are readily adjustible when motion is reversed. There are seven sizes of motor; from one-sixth to five horse-power.

Locomotive Sanders.

We are informed by the American Locomotive Sander Co. of Philadelphia that it has obtained control of the Sherburne sander, which has heretofore been sold by the Automatic Track Sander Co. of Boston. The latter company has retired from business, and Mr. Sherburne becomes a stockholder in the American company.

Tar-Macadam Pavement in Ontario.

It appears that the city of Hamilton, Ont., is laying more or less tar-macadam pavement. This consists of 2-in. stone, well coated with hot tar by being immersed, using from eight to 12 gallons to the cubic yard. This is laid on a properly prepared foundation, and is covered with a layer of gravel and quarry chips, also mixed with tar. Our Consul there says that experiments with this pavement have been carried on for a number of years, and that it is not only a smooth, solid pavement, but easily maintained. The first cost there, limestone being abundant, is from 70 to 86 cents per square yard, and the engineer estimates the cost of repairs on streets with heavy traffic at one cent a yard per year, while asphalt costs them three cents.

Lighting and Brakes in India.

From the latest annual report on the Indian railroad we learn that the progress of the Pintsch compressed gas system continues. On the Bombay, Baroda & Central India all of the passenger stock as well as the brake vans for the freight trains has been fitted with Pintsch apparatus, and during the year a few brake vans were fitted for burning gas in the side and tail lamps. From the results obtained it has been arranged to fit up in a similar way all of the brake vans. All of the important railroads now have a greater or less number of passenger cars equipped for lighting by this system, and from year to year additional stock is so fitted. The equipment of rolling stock with the automatic vacuum brake goes on, but according to the tables there is a very large amount of the stock yet to be equipped. The principle of the use of the automatic vacuum, however, seems to be thoroughly entrenched, as we hear nothing of pressure brakes.

THE SCRAP HEAP.

Notes.

Mr. Charles M. Schwab, President of the Carnegie Steel Co., is to establish a trade school for boys in or near Pittsburgh.

Brown's discipline abolishing suspensions is to be introduced on the Union Pacific and on the Oregon Short Line on Sept. 1.

The Baltimore & Ohio is to introduce the (manual) block system on its main line from the Ohio River to Chicago. This part of the road is mostly single track.

The Baltimore & Ohio has established the office of Industrial Agent. The agent is Mr. G. L. Stewart, of the Maryland Agricultural College, and he is to disseminate scientific agricultural knowledge among the farmers in the territory adjoining the road.

The Chicago & Alton is to furnish one uniform free each year to employees required to wear uniforms who have been in the service of the company five years. To those who have served 10 years or more two uniforms will be given annually. Each passenger trainman who has served acceptably five years will hereafter wear a silver star on his left sleeve and an additional star will be worn for each three years beyond five.

The General Superintendent of the Delaware, Lackawanna & Western has issued a general order designed to promote the safety of freight trains. Conductors must avoid stopping on curves where possible; when a flagman is recalled the train must be moved to a straight line; a flagman, when called in at night must, the last thing before he starts, place a lighted fusee on the track. Enginemen must not pass a station without receiving an all-right signal from the conductor, and if it is not forthcoming he should call for brakes. In descending steep grades the conductor should give an all-right signal to the engineman every three to five miles, the signal to be answered by the whistle. "When a stop is made, every person connected with the train should examine the couplings and running gear of all cars."

Traffic Notes.

At a meeting of the Hay Association of Baltimore, Aug. 16, an address on railroad rates was delivered by Mr. E. A. Moseley, Secretary of the Interstate Commerce Commission.

The Northern Pacific has issued notice that hereafter the passenger department will not bother the conductors on the company's trains with notices of tickets which have been lost. Requests for the issuance of notices of this kind, asking conductors not to honor the tickets, have become so numerous that conductors are unable to keep track of them. The newspapers say that other railroads have taken similar action.

The Merchants' Association of New York, having made little or no impression on the Classification Committee of the Southern railroads, in the matter of its complaint about increases of rates, is going to take its case to the Interstate Commerce Commission. By changes in classification, which were put into effect June 1, the rates on about 1,700 different commodities were raised, and the New York wholesalers claim that this advance will greatly reduce the area and territory in which they can sell goods.

The ticket scalpers of Philadelphia and Pittsburgh are said to be preparing to appeal to the Supreme Court of the state in the matter of the state law forbidding the sale of tickets except by authorized agents of carriers. In a case recently decided by the Superior Court the law was sustained, but the scalpers say that they are going to continue their efforts to have it declared unconstitutional. This law has been on the statute books many years and it has been generally understood to be effective, but it is now said that in the city of Pittsburgh violations have been very common.

Electric Railroads for Birmingham, England.

Our Consul in Birmingham thinks that within a year a short piece of overhead trolley electric road will be working in that city. The City Council has granted the privilege of putting up a short experimental line. The steam tram system of Birmingham is owned by a group of Toronto capitalists, who bought the property some time ago, expecting to develop an extensive electrical system, but they have met with serious obstacles in the lack of a public opinion familiar with the advantages of electric roads, and also in the opposition of the city authorities, who appear to be pretty strongly tinctured with the municipal ownership idea. In the course of his remarks on this matter the Consul makes some interesting suggestions about the outcome of the present tendency towards municipal ownership. One of the difficulties that Birmingham will meet if an attempt is made to buy and change the railroads there by the municipality, will be to get money. Up to three years ago the bonds of the best managed British cities could be sold on a 2¾ per cent. basis, and nearly all cities could get unlimited money at 3 per cent. Well informed municipal officers have recently expressed doubts if the cities will ever again be able to borrow money at such low rates. Three and one-half per cent. is now probably about the average, with a tendency to advance. It is suggested that part of this may be due to the growth of local indebtedness and part to the fear which capitalists have of the effects of the growth of the movement for municipal ownership. This fear is widespread.

Washout on Guatemala Railroad.

Consul-General McNally reports from Guatemala, July 27, 1900, that a serious washout has occurred on the Northern Railroad, which extends from Puerto Barrios to El Rancho. Several bridges have been destroyed, and traffic is interrupted. The mails from the United States are delayed four or five days. The Government has appointed engineers to estimate the damages, with a view to immediately repairing the line.

A G. P. A. on American Passenger Trains.

Our passenger cars excel those of foreign countries in all that goes to make up the comfort and convenience of a journey. Our sleeping and parlor car system is vastly superior to theirs. The lighting of our trains is superb, while the lighting of trains on most foreign lines is wretched. I may be pardoned for citing two examples of what I mean by the unsurpassed passenger train facilities of American railroads. A single locomotive recently hauled a passenger train of 16 cars, nine of which were sleeping and parlor cars, from New York to Albany, a distance of 143 miles, in 3 hours and 15 minutes, which is 44 miles per hour, and is the regular schedule time of this train. The train weighed 1,832,000 lbs., and was 1,202 ft., or nearly a quarter of a mile long. [See *Railroad Gazette*, Sept. 15, 1899.] The Empire State Express has for years been making the run from New York to Buffalo, 440 miles, in 8 hours and 15 minutes, an average speed of 53 1-3 miles an hour, including four stops—two of them for changing engines—and twenty-eight slow-downs, on account of running through incorporated towns and cities. For one stretch of 22 miles, another of 17 miles, another of 16 miles, and another of 60 miles, the regular schedule time is exactly 60 miles an hour. For one stretch of 12 miles it is 63.40 miles an hour. For another stretch of nearly 10 miles it is 64.86 miles an hour. The weight of this train is 608,000 lbs., and it has a seating capacity for 248 passengers. These are some of the achievements of American railroads in passenger service that have not been approached in any other country on the globe.

Siamese Market for Railroad Materials and Firearms.

Minister King, of Bangkok, has succeeded in securing an open tender for American manufactures in the construction of the Petchaburee Railroad by the Siamese Government. Bids for a plant for the manufacture of ammunition in that country were opened to American competition in March, and a bid was asked from the United States on 20,000 rifles and 10,000,000 cartridges.

The Russian Locomotive Works of Charkoff.

The locomotive works of Charkoff were founded in 1895, and have their headquarters at St. Petersburg. The city of Charkoff is the industrial and metallurgical center of Southern Russia, and at the same time an important railroad point; it is situated on three great trunk lines. The shops occupy an area of about 27 acres, whilst a similar acreage has been reserved for dwellings for artisans. The works consist of two main buildings: the locomotive shops proper, and the shops for the construction of machine tools. The latter is a very extensive plant, and its erection was chiefly due to Mr. Philip Bouhey, partner of the Paris machine tool manufacturing concern of E. & Ph. Bouhey. Mr. Bouhey is said to be largely interested in the Charkoff works. At the beginning of the year 1897 the company received an order from the Russian Government for 480 locomotives, to be built and delivered within six years. Besides this, the company, which now employs 3,500 men, received an order for 40 locomotives for the Chinese Eastern Railway.

The Change of Gage on the Denver & Rio Grande.

The latest annual report issued by the President of the Denver & Rio Grande Railroad informs us that in the year reported on the standard gage main line was improved by laying 8,000 tons of 85-lb. rail. This released 65-lb. and 52-lb. rail for use in standard gaging part of the narrow gage system. More than 200 miles of the standard gage main tracks is now laid with 80-lb. rail. The work of standard gaging from La Vita to Alamosa, about 61 miles, was completed last autumn and the line opened for traffic. The President suggests that as Alamosa, which is in the center of San Luis Park, commands a district of growing commercial and mining importance it may be desirable to extend the standard gage westward to Creede, 70 miles, southward to Antonito, 29 miles, and perhaps north 55 miles to Villa Grove. The company now has 743 miles of standard gage, 932 miles of narrow gage and 300 miles laid with the third rail, this latter being included in the mileage noted above.

The Kansas Terminals of the Chicago Great Western.

In the latest annual report of the Chicago Great Western Mr. Stickney speaks of the terminals building at Kansas City. About a year ago the company bought 20 acres of land at $5,000 an acre and has contracted to grade it at $3,000 an acre, making a total cost of $8,000 an acre, which the President considers exceedingly low, as compared with $100,000 an acre for an earlier purchase. The Terminal Railway Company of Kansas City was organized to procure and hold the title, all the stock being held in the treasury of the Chicago Great Western. The yard will be 3,700 ft. long, 500 ft. wide and will have a roundhouse, warehouses, etc. It is estimated that the saving in switching charges will equal the interest on the whole investment, but its principal justification will be increased business and reduced cost of operation.

Improved Service in New Zealand.

The management of the Government Railroads of New Zealand has completed plans for important reductions in rates and improvements in service. According to Herapath's *Journal*, workmen's tickets will be issued to and from the suburbs of the principal towns at 2 shillings a week. The reduction in some cases will be more than 50 per cent. These tickets will be available for distances of 12 miles, making the rate for the longest rides one-third of a cent a mile. Single ticket rates throughout the colony are to be reduced to 1 penny (2 cents) a mile. From Dunedin to Christchurch the reduction in fare is from 47s 4d to 28s 10d. Forty new locomotives, 40 passenger cars and 3,000 freight cars are to be built or bought at once. Interlocking apparatus for switches and signals is to be put in at a number of places and the electric train staff is to be introduced. All the cars and engines are to be fitted with Westinghouse air-brakes, and the speed of trains is to be increased on many of the lines. A fund is to be established to provide annuities for superannuated employees.

Rear Collision in Italy.

The rear collision of passenger trains on the night of Aug. 12 at Pont Salario, Italy, near Rome, turns out to have been a serious one; 15 persons were killed and 40 were injured. The trains carried many distinguished persons who were returning from the funeral of the King of Italy.

LOCOMOTIVE BUILDING.

The Rio Grande Western is having one engine built by the Schenectady Locomotive Works.

The Grand Trunk has ordered six of the locomotives referred to last week from the Dickson Locomotive Works.

The Norfolk & Western order with the Baldwin Locomotive Works, referred to Aug. 17, calls for ten 10-wheel simple engines to weigh 155,900 lbs. with 121,650 lbs. on the driving wheels. They will have 19 in. x 28 in. cylinders; 56 in. driving wheels; boilers of the radial stay wagon top type, with 281 charcoal iron tubes 2¼ in. in diam. and 13 ft. 10 in. long and a working steam pressure of 200 lbs.; fire-boxes, Carbon steel, 112½ in. long and 41¾ in. wide; and a tender capacity of 5,000 gals. of water and 10 tons of coal. The specifications call for Westinghouse brakes, Monitor injectors, U. S. metallic piston and valve rod packings, Ashton safety valves, Leach sanding devices, Nathan lubricators, French springs, Ashton steam gages, Standard driving and truck wheel tires and N. & W. standard brake-beams and brake-shoes. The road will furnish the couplers and headlights.

CAR BUILDING.

The Missouri Pacific has ordered 500 flat cars from the Pullman Co.

W. J. Rainey has ordered 200 freight cars from the South Baltimore Car Works.

The Buffalo & Susquehanna is having one passenger car built by the Barney & Smith Car Co.

The Vandalia has ordered 100 coal cars of 80,000 lbs. capacity from the American Car & Foundry Co.

The Louisiana & Arkansas has ordered 25 flat cars, 40 ft. long, from the American Car & Foundry Co.

The Gulf & Ship Island has ordered one baggage and four passenger cars from the American Car & Foundry Co.

Carr Bros., 61 Broadway, New York, have ordered 100 freight cars, presumably for export, from the South Baltimore Car Works.

The Intercolonial of Canada is asking prices on 250 box cars of 60,000 lbs. capacity and is reported in the market for a number of flat cars.

The American Car & Foundry Co. has received orders from miscellaneous companies for 25 coal, five bone and 30 mine cars; also an order for 10 box cars for export.

The Kansas City, Ft. Scott & Memphis order with the American Car & Foundry Co., referred to Aug. 17, calls for 100 coal cars of 60,000 lbs. capacity, for October delivery. They will measure 34 ft. long and have Shickle, Harrison & Howard steel bolsters and trucks, Sterlingworth brake-beams, Westinghouse brakes, Chicago couplers, malleable iron journal boxes and Scott springs.

BRIDGE BUILDING.

ALEXANDRIA, LA.—The Alexandria & Pineville Bridge Co. has had its plans approved by the Secretary of War for the bridge over the Red River. Soundings for the foundations will be made immediately. (Construction Supplement, July 27, 1900.)

BALTIMORE, MD.—The County Commissioners have increased the county appropriation towards a bridge over the grade crossing of the Baltimore & Potomac on Wynans avenue in the Thirteenth District. The bridge will be built by the railroad at a cost of $12,000.

BILOXI, LA.—Municipal bonds for $17,000 have been sold for a bridge over Back Bay and work will be begun as soon as the War Department has approved of the plans and specifications.

BINGHAMTON, N. Y.—Bids are asked for the Hotchkiss street bridge in this city.

BOISE, IDAHO.—The Ten-Mile Reservoir & Bridge Co., of Boise, has been incorporated in Idaho, with a capital stock of $750,000. Among the incorporators are F. O. Bryant and Jay Turley.

CHARLESTON, S. C.—The bridge owned by the Charleston Bridge Co., of which Geo. W. Williams, Jr., is Vice-President, was partially wrecked Aug. 14. The estimated damage is $14,500.

CLEVELAND, OHIO.—Plans have been submitted by the Big Four for the new rolling lift bridge to replace the present structure over the Cuyahoga River from the foot of South Water street. The estimated cost is $100,000. (Aug. 17, p. 559.)

EUFAULA, IND. T.—The trestle bridge of the Missouri, Kansas & Texas across the new channel of the South Canadian River, five miles south of this point, was partially destroyed by fire Aug. 17.

HARRISBURG, PA.—The County Commissioners have decided to build a new bridge at once at Shanois street over Paxton Creek, and contracts are pending.

HINTONBURG, ONT.—Petitions have been presented to the Nepean Township Council for a bridge across the Jack River on the Third Concession. An engineer will be engaged to prepare plans and estimates.

LITTLE FERRY, N. J.—Bids are asked until Sept. 5 by a committee of the Board of Chosen Freeholders for a bridge at that point.

LOWELL, MASS.—The Street Committee of the Board of Aldermen is considering a new bridge to replace the Pawtucket bridge, which the City Engineer has declared unsafe. The estimates are from $32,000 to $50,000.

MCKEESPORT, PA.—The National Tube Works is asking bids for a bridge over the railroad at Fourth and Locust streets.

MEDIA, PA.—The Delaware County Commissioners, on Aug. 27, granted permission to the Philadelphia & Delaware Trolley Co. and the Prospect Street Ry. of Chester to build two bridges on the Island Road along the river front between Philadelphia and Chester. They will be draw bridges, 48 ft. and 100 ft. long respectively, and each 26 ft. wide and will cost about $60,000.

MOUNT VERNON, N. Y.—Bids were opened, Aug. 21, for four bridges: Over South Fulton avenue, over East Lincoln avenue, over East Third street and over East Sixth street. The lowest bidders were the Wrought Iron Bridge Co., $39,792, and the Frank R. Long Co., $41,159. All other bids were rejected. (Aug. 24, p. 573.)

NEWBURYPORT, MASS.—The County Commissioners have decided to build a new bridge across the Merrimac, but its exact location is not yet determined.

OTTAWA, ONT.—Tenders are being asked by Joseph R. Roy, Acting Secretary of the Department of Public Works, for a bridge to be known as the Des Joachims Interprovincial bridge over the main channel of the Ottawa River opposite the upper slide at Rapids des Joachims, County of Pontiac, Quebec.

READING, PA.—The Phoenix Bridge Co. has the contract for building five steel bridges for the Reading Belt line of the Philadelphia & Reading. (Construction Supplement, July 27, 1900.)

SAYRE, PA.—The viewers appointed by the court with reference to a county bridge across the Susquehanna River at this point have reported favorably.

SYRACUSE, N. Y.—Property holders of Catherine street and vicinity have petitioned for a new bridge over the Erie Canal from that street.

WELLSBORN, TEX.—A petition has been made to the County Commissioners for a new bridge across the Brazos River opposite Wellsborn.

WEST FAIRVIEW, PA.—The Northern Central wooden bridge over the Conodoguinet Creek at this place is to be replaced by a double track iron structure.

YARDLEY, PA.—The Philadelphia & Reading will spend about $20,000, according to report, on the bridge at this point.

Other Structures.

ATLANTA, GA.—The railroads have been allowed until Sept. 17 to prepare plans for a union station at this point. (Nov. 17, 1899, p. 798.)

DULUTH, MINN.—The Northern Pacific has prepared plans for a freight office and warehouse 425 x 54 ft. The office portion will be 50 x 54 ft.

DUNKIRK, N. Y.—The Erie, according to report, will remodel its station at this point.

HENDERSON, N. C.—The Seaboard Air Line will build a new station and freight depot at this place.

LE ROY, N. Y.—The Buffalo, Rochester & Pittsburgh will at once rebuild its station which was destroyed by fire June 16.

LEVIS, QUE.—Tenders for the new station of the Intercolonial will be called for next week. The station will also be used by the Grand Trunk and the Quebec Central. About 15,000 ft. of track will be built. There will be direct communication from the wharf to the railroad. The station will be 175 ft. x 70 ft., and will have a galvanized iron roof. (July 13, p. 486.)

NEW ORLEANS, LA.—An ordinance is before the Council relative to the building of a new station by the Louisville & Nashville on the present site at the head of Canal street. The estimated cost, including car sheds, is $50,000.

SAN BERNARDINO, CAL.—Extensive additions are to be made to the Atchison, Topeka & Santa Fe shops at this point.

SAN FRANCISCO, CAL.—The Southern Pacific is reported preparing to build a new passenger and freight station south of Market street.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xi.)

The Railway Signaling Club.

The next meeting of this Club will be held at Haddon Hall Hotel, Atlantic City, N. J., Sept. 11. The hotel gives a rate of $2 a day. Papers will be presented on Automatic Block Signal Failures Due to Lightning, by H. D. Miles (Michigan Central); and on Back Lights, by W. H. Lane (Lehigh Valley.)

Traveling Engineers' Association.

The eighth annual convention of the Traveling Engineers' Association will be held at Cleveland, Ohio, beginning 9 a. m., Sept. 11. The headquarters and the meeting room will be in the Colonial Hotel. Arrangements have been made with the Pullman Company for a rate of half fare for members and their families to and from the convention.

St. Louis Railway Club.

The September meeting of this Club will be held Friday, Sept. 14, beginning the fall work. Notice of the hour, the subject and the author will shortly be given. The August issue of the Proceedings contains a paper by Mr. Daniels, on "American Railroads," and one by Mr. Flynt, on "Railroad Police Organization and the Tramp Problem." The reader will remember that Mr. Flynt has opened up a field of his own in studying and writing about the tramp, and that he made particularly careful studies on the lines of the Pennsylvania Railroad West of Pittsburgh, some of the results of which appear in this paper.

Texas Railway Club.

The Fall meeting of the Texas Railway Club will be held at the Tremont Hotel, Galveston, Tex., on Monday and Tuesday, Sept. 17 and 18. The following programme will be presented: "The Electric Headlight," by Mr. S. R. Tuggle, Superintendent of Motive Power, Houston & Texas Central Ry.; "A System of Technical Training for Railway Employees," by Mr. E. B. Cushing, General Superintendent, Houston East & West Texas Ry.; "Recent Advances in the Heating of Railway Passenger Equipment," by Mr. W. P. Cosper, Consolidated Car Heating Company; "Decoration of Railway Grounds and Maintenance of Stations," by Mr. A. N. Leitnaker, Vice-President and General Superintendent, Austin & Northwestern R. R. Mr. Ira B. Kegler, of the Patterson-Sargent Company, will also present a paper, the subject of which is not yet announced.

PERSONAL.

(For other personal mention see Elections and Appointments.)

—Mr. J. V. Mahoney, of Sioux City, Iowa, has been appointed Superintendent of the passenger department of the Bureau of Transportation.

—Mr. W. C. Willson, President and General Manager of the Crooked Creek, died Aug. 17, as the result of injuries received by a car falling upon him. He was 76 years old.

—Mr. Fairman Rogers died in Paris Wednesday of last week. He was a member of the American Society of Civil Engineers and was well known by engineers and by sportsmen.

—Mr. D. B. Ely, formerly Vice-President and General Manager of the Missouri Midland R. R., and who, in 1899, financed the building of that road, has formed a connection with Cortlandt, Babcock & Co., 44 Pine street, New York. Mr. Ely will give special attention to railroad loans.

—Mr. Thomas J. Klase, formerly General Eastern Freight Agent of the Lehigh Valley, died of pneumonia, Aug. 25, at his home in Cranford, N. J. Mr. Klase was a native of Mainville, Pa., and was 51 years old. His railroad career was begun in 1865 in the service of the Philadelphia & Reading.

—Mr. G. H. Longbottom, for some time Secretary of the Rogers Locomotive Co., has been elected President to succeed Mr. Robert S. Hughes, whose death was recorded in our issue of Aug. 17. Mr. G. E. Hannah, Treasurer of the company, has been appointed Secretary in addition to his other office.

—Mr. John Webster Wardwell, at one time Receiver and General Manager of the Cleveland, Canton & Southern, died at Cleveland, Ohio, Aug. 22, aged 68 years. He was born at Salisbury, Merrimack Co., N. H., and began his railroad career in 1858 as passenger conductor and cashier on the Boston, Concord & Montreal (Boston & Maine). Mr. Wardwell was from that time, until 1886, connected with other roads in minor positions. In January of 1886 he became General Superintendent of the Cleveland, Canton & Southern, and seven years later Receiver.

—Mr. J. S. Norris is to be Division Superintendent of the Eastern District of the Pittsburgh Division of the Baltimore & Ohio under the reorganization of the divisions. He was born Jan. 8, 1857, at Baltimore, Md. His first railroad service was with the Baltimore & Ohio as fireman, in January, 1883. He served as fireman and engineman until 1890, when he was made Assistant Trainmaster on the First Division. Five years later he was appointed Trainmaster of the division, and, in September, 1897, to his present position of Division Superintendent of the Connellsville Division.

—Mr. C. N. Davids is the Purchasing Agent of the Colorado Midland, with office at Colorado City, Colo. He was born in Marion, Ohio, in July, 1857, and began his railroad service as a telegraph operator on the Cleveland, Cincinnati, Chicago & St. Louis in 1873. He served as operator and express agent with the Louisville & Nashville, the Union Pacific and the Denver & Rio Grande until October, 1879, when he entered the Supply Department of the Denver & Rio Grande, at Chama, N. Mex. He served with that company as division storekeeper, brakeman and conductor until 1886, when his present company, the Colorado Midland, was organized. He entered the service of that road as chief clerk to the Chief Engineer of Construction. After two years he was appointed General Storekeeper at Colorado City, and continued in that position until July 12 last, when, in addition to these duties, he was appointed Purchasing Agent.

—Mr. Geo. D. Wadley, as recently noted, has been elected Vice-President and General Manager of the Waycross Air Line. Mr. Wadley was born in Washington County, Ga., Nov. 15, 1857. He entered railroad service in 1884 as Superintendent of Construction on the Central of Georgia, with which company he continued until March, 1887. He then took service with the Mexican National and later with the Louisville & Nashville, leaving the latter company in 1889 to accept the position of Chief Engineer and General Manager of the Kentuck Union (now part of the Lexington & Eastern.) A year later he was placed in charge of the construction of the South Bound R. R., and upon its completion was made General Manager. In 1891 he was appointed General

Superintendent of the Central of Georgia. For the last three or four years he has been building railroads in Mexico as Superintendent of Construction of the Mexican National.

—Mr. G. P. Smith, who recently resigned as Chief Engineer of the St. Joseph & Grand Island, was born at South Deerfield, Mass., in March, 1862. He was graduated from the Worcester Institute of Technology in 1885. He entered railroad service the same year with the Burlington & Missouri River as draughtsman, and continued with that company, serving as Division Engineer on Maintenance of Way from May, 1887; as Division Engineer on Construction from April, 1888; as Resident Engineer on Maintenance of Way from November, 1888, and as Resident Engineer on Construction from June, 1894, to March, 1895. He continued with the company until January, 1896, in connection with the track department. Then for 18 months he was draughtsman with the Lassig Bridge & Iron Works, of Chicago. He was appointed with his present company, the St. Joseph & Grand Island, as Division Engineer, in June, 1897, and was appointed Chief Engineer in August the following year. His resignation takes effect Sept. 1.

—Mr. E. C. Brown, on Aug. 1, was appointed Engineer of Maintenance of Way of the Union R. R., at Port Perry, Pa. He was born in Athens, Ohio, in 1863, and was graduated from the high school at Columbus, Ohio, in 1883. He began his railroad work as a draughtsman in July of the same year in the office of the Chief Engineer of the Pittsburgh, Cincinnati, Chicago & St. Louis. He served until 1890 with the same company as rodman and transitman. Afterwards he was transferred to the Pennsylvania as Division Engineer on Construction of the Trenton cut-off, and from 1890 to 1893, on the Cambria & Clearfield division. During portions of the years from 1894 to 1896 he was Resident Engineer in charge of railroad and blast furnace building in North Michigan for the Cleveland Cliffs Iron Co. In May, 1896, he entered the service of the Pittsburgh, Bessemer & Lake Erie on the location and building of the river extension. In November, 1897, he was appointed Supervisor of the North Division of the same road, and in July, 1899, Assistant Engineer, the position he held at the time of a recent change.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe.—J. M. Wells has been appointed General Foreman of Bridges and Buildings on the Middle Division, with headquarters at Newton, Kan.

Denver & Rio Grande.—W. S. Martin, heretofore Division Superintendent of the Louisville & Nashville, has been appointed General Superintendent of the D. & R. G., succeeding N. W. Sample.

Erie.—H. B. Chamberlain has been appointed Eastern Freight Traffic Manager of this company and Freight Traffic Manager of the New York, Susquehanna & Western, succeeding Frank Harriott, resigned, effective Aug. 20.

Great Northern.—Prescott B. Beidelmon has been appointed Chief Clerk for D. Miller, Second Vice-President.

Gulf & Brazos Valley.—O. G. Hurdleston, Superintendent, and O. J. Watrous, General Freight and Passenger Agent, having resigned, the offices of Superintendent and General Freight and Passenger Agent have been abolished, effective Aug. 20.

Jamestown & Chautauqua.—Hon. S. Fred Nixon has been elected Vice-President.

Kansas City, Fort Scott & Memphis.—Nathaniel Thayer has been elected Vice-President.

Ohio Southern.—S. W. Crawford, heretofore General Foreman, has been appointed Master Mechanic, with headquarters at Springfield, Ohio, succeeding A. E. Tremp.

Philadelphia & Reading.—H. H. Barr has been appointed Supervisor, with headquarters at Reading, Pa., succeeding J. W. DeMoyer. H. B. Glisson, heretofore Assistant Supervisor at Philadelphia, Pa., has been appointed Supervisor, with headquarters at Lebanon, Pa.

San Francisco & San Joaquin Valley (A., T. & S. F.).—M. A. Barmann has been appointed Resident Engineer, with headquarters at Stockton, Cal.

St. Louis & San Francisco.—Q. Allen, Foreman Car Department at Springfield, Mo., has resigned, effective Sept. 1.

Texarkana, Shreveport & Natchez.—F. W. McMillan has been appointed General Freight Agent, with headquarters at Texarkana, Ark.

Toledo, St. Louis & Western.—The following, including those given on p. 545, are the officers of this company, successor to the Toledo, St. Louis & Kansas City: Chairman of the Board, W. A. Reed; Vice-President, Henry Budge; Secretary and Treasurer, Jos. H. Seaman; General Counsel, A. H. Joline; and General Solicitor, C. Brown. The Directors are: F. P. Olcott, Henry Budge, J. Kennery Tod, William A. Read, James N. Wallace, O. H. Tweed, C. S. W. Packard, J. Crosby Brown, Benjamin Norton, Alfred Pick and Joseph H. Seaman. The position of Superintendent has been abolished.

Union Pacific.—Gerrit Fort, heretofore Secretary of the Central Passenger Association, has been appointed Assistant General Passenger Agent of the U. P., with headquarters at Omaha, Neb., effective Sept. 1.

Warren & Corsicana Pacific.—The position of Traffic Manager has been abolished.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Angelina & Weches.—This company has been incorporated in Texas, with a capital stock of $75,000, to build a railroad in Angelina County from Keltys to Manton, 12 miles.

Brainerd & Northern Minnesota.—Halverson & Co., of Minneapolis, are reported to have the contract for an extension from Bemidji, Minn., to run north 91 miles to Big Fork. It is stated that 37 miles will be completed this winter and the rest early next spring. (March 31, 1899, p. 235.)

British Columbia Roads.—John A. Manley, of Grand Forks, representing a number of Canadian capitalists, is making application for a charter to build a road from the Columbia Western branch of the C. P. R., into Republic, about 40 miles.

Buffalo & Susquehanna.—Grading is begun on a branch from Mapes, N. Y., west six miles to Jones Corners. It is proposed to extend the line ultimately to Ceres on the Pittsburgh, Shawmut & Northern.

Cape Breton.—The Manhattan Contracting Co. has taken the contract for building this line which is projected from Louisburg, on the east coast of Cape Breton Island, N. S., to run southeast 86 miles to Hawkesbury, on the Straits of Canso, with a branch to Sydney. The intention is to run fast steamers from the terminus of the road to Liverpool. The estimated cost of the road is $3,000,000. There will also be required a bridge across the Strait of Canso to cost about $5,000,000. It will be built of steel and be about three-fourths of a mile long. The road will be single-track, laid with 70-lb. steel. The final survey is nearly completed and building is to be begun within one month. The Canadian Government has granted subsidies of $3,200 per mile and the remaining cost will be provided for by an issue of bonds. The capital stock is $1,000,000. Robert J. Campbell, of New York, is President, and Edmund Guerin, Q. C., of Montreal, is Counsel.

Chesapeake & Nashville.—A syndicate is being formed, according to report, to take over this line which runs from Gallatin, Tenn., to Scottsville, Ky., and to extend it from Gallatin to Nashville, and from Scottsville to a connection with the Southern Ry. at Bloomfield, Tenn.

Chicago, Indiana & Eastern.—A loan for $1,000,000 has been filed by the New York Security & Trust Co., at Muncie, Ind., for this company's extension from Matthews to Muncie. (Construction Supplement, July 27, 1900.)

Chilkoot Pass.—The Arctic Construction Co. has been organized at Skagway, Alaska, to build this line from Dyea and Skagway, Alaska, north under Chilkoot Pass. A. B. Miller, Seattle, Wash., and H. O. Peterson, Skagway, are trustees. Henry Schafer, Skagway, has the subcontract for 10 miles. Building was to be begun Aug. 16. (Construction Supplement, July 27, 1900.)

Cleveland, Lorain & Wheeling.—Preliminary surveys are being made, according to report, for a cut-off between Massillon, Ohio, and Navarre, which will shorten the road about three-fourths of a mile and do away with three bridges.

Colorado Midland.—Preliminary surveys are in progress for a cut-off from near Thomasville, Colo., along the Frying Pan Creek to Basalt. The cut-off would do away with between 30 and 40 sharp curves and a number of steep grades.

Delaware & Hudson.—Sunstrom & Stratton, 100 Broadway, New York, have the contract for grading and masonry for grade reduction on about 4½ miles of the line from Windsor, N. Y., to East Windsor, on the Nineveh Branch. The company will do the work of reducing grades for about 1½ miles south from Nineveh on the same branch. (Aug. 24, p. 574.) The reductions will be from 30 ft. maximum to 15 ft. to the mile. (Official.)

Denver & Rio Grande.—In the annual report just issued, the President suggests the standard gaging of the branch from Alamosa, Colo., to Creede, 70 miles, and also of another branch from Antonito to Villa Grove, about 84 miles.

Emporia & Gulf.—This company has been incorporated in Texas, with a capital stock of $100,000, to build a railroad from Emporia to Prescott, 25 miles. The incorporators are: S. F. Carter, E. J. Mantooth, J. P. Carter, E. W. Scott, R. L. McCarty, W. B. Banks, A. M. Denman, E. L. Crooker, L. Davidson, F. H. Ray.

Erie.—Bids are being asked for eliminating grade crossings at Middletown, N. Y., on the New York, Susquehanna & Western.

James Maybury & Son, of Passaic, N. J., have the contract for abolishing the grade crossings at the Park Street Station, Montclair, N. J., by the raising of the track seven or eight feet at the crossing of the Valley Road, and the consolidation of the crossings over Watchung avenue and Park street. Building is in progress.

Eureka & Freshwater.—This company has been incorporated in California, with a capital stock of $200,000, to build a line from Eureka, Humboldt Bay, along Freshwater Slough, 12 miles. C. A. Hooper, I. C. Henry and David Evans are incorporators.

Georgia Pine.—An amended charter has been granted in Georgia to extend this company's line north from Arlington, Ga., about 16 miles, and southeast from Bainbridge, Ga., to Tallahassee, Fla., about 40 miles. It is stated that building is to be begun in a few days. (Construction Supplement, July 27, 1900.)

Great Eastern.—A new charter has been obtained in North Carolina permitting the company to build from Raleigh east 160 miles to Englehard, in Hyde County, where a steamboat connection will be made for Norfolk and other tidewater points in Virginia. The capital stock is $2,000,000. J. W. Lynch, of Kinston, N. C., is President. (Aug. 3, p. 531.)

Hocking Valley.—Estimates are reported being prepared for a line from Wellston, Ohio, southeast about 50 miles to Huntington, W. Va., the line to be built another season.

Lake Michigan & Southeastern.—This company was incorporated in Ohio, Aug. 20, with a capital stock of $10,000, to build a railroad from a point on the Michigan State line southeast through Williams, Fulton and Henry counties to Napoleon. The incorporators are: Edward Gaudern, James O. Marshall, U. P. Gostschius, T. R. Davis and Frank G. Kohle.

Louisville & Nashville.—Surveys are reported completed for a branch line from Pittsburgh, Ky., on the main line, east 30 miles to Manchester. (Construction Supplement, July 27, 1900.)

Mexican Roads.—Work will be begun soon, according to report, on a line from Monterey, Mex., to the San Carlos foundry.

Missouri, Kansas & Texas.—The people of Wise County, Tex., have guaranteed right of way through the county and $50,000 bonus for an extension of the Sherman, Shreveport & Southern from McKinney west about 75 miles through Denton and Decatur to Bridgeport.

New Jersey Roads.—Richard Howell, of Wilmington, Del., is President of a company which is reported making a survey for a proposed railroad from Buttsville to ice houses at Green's Pond, Warren County, three miles.

New York, New Haven & Hartford.—Extensive yards and terminals are reported being arranged for in South Boston, Mass.

Northern Ohio Valley Electric.—Surveys are about half completed for this proposed electric line from Wheeling, W. Va., to Wellsburg, 16 miles. Not all of the right of way is yet obtained. It will consist of low grades and the curves will be slight except three, of which one is at the railroad crossing. There will be three bridges of about 120 ft. span. Howard Hazlett is President; John S. Welty, Vice-President; John P. Arbenz, of Wheeling, Acting Secretary and Treasurer; Robert Hazlett and H. L. Arbenz, Engineers. (Official.)

Oswayo.—This company has been incorporated to build a railroad five miles long from Ceres, N. Y., southeast to Shingle House, Pa. W. F. Copp is President, and H. S. Hasings Secretary and Treasurer, both of St. Marys, Pa.

Pennsylvania.—The Drake & Stratton Co. has taken the contract for straightening the line of the Pittsburgh, Virginia & Charleston from the Panhandle across the Monongahela River in Pittsburgh to Beck's Run.

Pennsylvania Roads.—Surveys are reported being made for a line from Coleman Station, on the Baltimore & Ohio, up Coleman Hollow to timber lands owned by E. P. Dalrymple.

Portland Railway & Terminal.—Surveys are reported completed for this company's terminal improvements along the shore at South Portland, Me. These include warehouses, wharves, a dry dock and connecting railroad spurs. Jesse Dyer, of Portland, Me., is interested.

Randsburg.—Surveys are reported completed for the proposed extension from Johannesburg, Cal., north about 65 miles to Ballarat. (June 2, 1899, p. 395.)

Shediac & Coast.—This company is being organized at Shediac, N. B., and preliminary surveys for a road from that city are to be made at once. A. S. Trueman, of Shediac, is President, and J. McQueen is Secretary.

Shreveport & Red River Valley.—This line now building to Colfax, La., is to be extended southeast to Alexandria, to connect with the Southern Pacific, and it is understood that an agreement has been entered into between the two companies for an interchange of traffic. (May 25, p. 348.)

Split Rock & Northern.—This company has been incorporated in Minnesota, with a capital stock of $20,000, to build a line from the mouth of Split Rock River, Lake County, to run north to the Canadian boundary line. Wm. Gratwick, of Buffalo, N. Y., is President; Clark W. King, Saginaw, Mich., is Vice-President; and T. D. Merrill is General Manager and Secretary.

Tennessee Central.—Right of way has been obtained for the proposed branch from Johnson's Stand, Tenn., on the Montgomery Division, to the coal lands of the Campbell Coal Co., at Atlanta, Ga., near Woody, Tenn., nine miles. (Aug. 10, p. 546.)

West Virginia Roads.—The Wilson Lumber Co., of Wilson, confirms the statement that it is building a line near Fairfax. It is to be about five miles long, narrow gage, to reach timber owned by the company. (Aug. 24, p. 574.)

GENERAL RAILROAD NEWS.

Boston & Maine.—The stockholders, on Aug. 23, voted unanimously to buy the preferred stock of the Central Massachusetts at 65. (Aug. 3, p. 532.)

Chicago, Burlington & Quincy.—Ninety-five 4 per cent. bonds, due Sept. 1, 1921, have been drawn for payment at par, at the New England Trust Co., Boston, on Sept. 1, interest to cease from that date.

Chicago, Greenville & Southern.—According to press reports, this property has been sold for unpaid taxes to H. W. Park, of Greenville, Ill. The line runs from Durley to Greenville, five miles, and has been operated under lease by the Jacksonville & St. Louis.

Erie.—The gross earnings for the year ended June 30, 1900, were $38,293,032, against $33,752,704 last year, an increase of $4,540,328. The net earnings for this year were $9,844,427, against $8,582,778, which is a gain of $1,261,649. The surplus this year after including other income and deducting fixed charges was $1,663,430, a gain of $1,009,632.

Ilwaco Railway & Navigation.—This property, extending from Ilwaco, Ore., to Nabcotta, 16 miles, has been bought by the Oregon Railway & Navigation. Possession will be taken Sept. 1.

Iron Range & Huron Bay.—This road, extending from Champion, Mich., to Huron Bay, about 62 miles, built several years ago, but never operated, is reported being dismantled.

Los Angeles Terminal.—Senator Clark, of Montana, is reported to have bought a half interest in this property, and will extend it to San Bernadino, Cal., and to Salt Lake City, Utah.

Oklahoma City Terminal.—This company, which proposes to build a terminal line about three miles long at Oklahoma City, Okla. T., is reported to have leased the property upon completion to the St. Louis & San Francisco. The plans include the building of a new station. (Railroad Construction, July 20, p. 502.)

Pittsburgh & Western.—Holders of preferred stock not heretofore deposited with the Knickerbocker Trust Co., are notified that the committee will receive the same and include them in the benefits in the recent contract of sale, provided they are deposited within 30 days from Aug. 22. (Aug. 3, p. 532.)

Rutland.—Application will be made to the next Vermont Legislature for an amendment to the charter permitting the company to buy and operate the Bennington & Rutland, the Rutland-Canadian, the Rutland & Noyan and the Ogdensburg & Lake Champlain railroad companies, and the Rutland Transit Co. The proposed changes include an increase in the capital stock and the right to take over other connecting roads. (March 16, p. 178.)

Toledo, St. Louis & Kansas City.—The second installment of $5 on the preferred stock and $3 on the common stock, is called for payment at the Central Trust Co., New York, Sept. 5. (Aug. 3, p. 532.)

Velasco Terminal.—This property is to be sold at public auction, Sept. 4, at Angleton, Brazoria County, Tex., the upset price being $50,000. (Aug. 3, p. 32.)